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Nova Scotia Technical College

Calendar

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Halifax, N. S.

1921 1922

FRONT VIEW OF MAIN BUILDING, NOVA SCOTIA TECHNICAL COLLEGE

COLLEGE CALENDAR.

1921

September	10, Saturday—	Registration for Civil Engineering Summer Camp.
September	12 to Oct. 2—	Civil Engineering Summer Camp.
October	3, Monday—	Registration for College Classes.
October	4, Tuesday—	Beginning of Regular Lectures.
December	23, Friday—	Beginning of Christmas Holidays.

1922

January	3, Tuesday—	Resumption of Regular Lectures.
January	3, Tuesday—	Beginning of Short Courses.
January	30, Monday—	Beginning of Mid-year Examinations.
February	8, Wednesday—	Beginning of Second Semester.
March	31, Friday—	Closing of Short Courses.
May	10, Wednesday—	Beginning of Final Examinations.
May	19, Friday—	Commencement Day.
May	22, Monday—	Beginning Summer Mining School.
June	17, Saturday—	Closing Summer Mining School.

PROVINCE OF NOVA SCOTIA.

Council of Public Instruction.

Hon. G. H. Murray, M. P. P., Premier and Provincial Secretary.
Hon. O. T. Daniels, M. P. P., Attorney-General.
Hon. E. H. Armstrong, M. P. P., Commissioner of Public Works and Mines.
Hon. H. H. Wickwire, Minister of Highways.
Hon. Jason M. Mack, M. L. C.
Hon. R. M. McGregor, M. P. P.
Hon. William Chisholm, M. P. P.
Hon. R. E. Finn, M. P. P.
Hon. J. C. Tory, M. P. P.
A. H. MacKay, LL. D., Superintendent of Education, Secretary.

NOVA SCOTIA TECHNICAL COLLEGE.

Board of Governors.

Dr. F. E. Wheelock, Acadia University.
Prof. W. H. Copp, Dalhousie University.
Prof. A. A. Sturley, University of King's College.
Dr. H. E. Bigelow, University of Mount Allison College.
Rev. H. P. McPherson, D. D., University of St. Francis Xavier College.
Rev. Bro. Cornelia, St. Mary's College.
Prin. F. H. Sexton, Nova Scotia Technical College.
Prof. F. R. Faulkner, Nova Scotia Technical College.
Prof. J. F. Lumsden, " " " "
Prof. G. F. Murphy, " " " "
Prof. E. D. Baker, " " " "
Prof. J. L. Bray, " " " "

NOVA SCOTIA TECHNICAL COLLEGE.

Instructing Staff.

F. H. Sexton, LL.D., D. Sc., Principal.
F. R. Faulkner, A. B., S. B., Prof. of Civil Engineering.
J. L. Bray, S. B., Prof. of Mining Engineering.
J. F. Lumsden, S. B., Prof. of Electrical Engineering.
E. D. Baker, S. B., Prof. of Mechanical Engineering.
G. F. Murphy, B. E., Prof. of Metallurgy.
R. P. Donkin, S. B., Asst. Prof. of Mechanical Engineering.
W. G. Hardy, S. B., Asst. Prof. of Civil Engineering.
A. H. Whitman, Instructor in Electrical Engineering.
B. C. Hunt, B. B. A., Prof. of Industrial Economics.
Judge W. B. Wallace, Lecturer in Law of Contracts.

Military Committee, Technical College C. O. T. C.

Prin. F. H. Sexton, *President.*
Capt. J. F. Lumsden, O. C. Tech. Coll. C. O. T. C.
Lt. Col. W. B. Anderson, G. S. O., M. D. No. 6.
Capt. W. G. Hardy, *Secretary.*
Capt. McCulloch, Instructor in Military Science.

H. Piers, Librarian and Curator of the Museum.
C. Gass, Accountant.
E. H. Nauss, Secretary.
M. G. Doyle, Engineer.

HISTORY.

The Nova Scotia Technical College was authorized by an Act of the Provincial Legislature in April 1907, (N. S. Laws, 1907, Chap. 1, Act Relating to Technical Education). The Act provides that

"There shall be established at Halifax an institution for the purpose of affording facilities for scientific research and instruction and professional training in civil, mining, mechanical, chemical, metallurgical and electrical engineering or any other departments which may from time to time be added.

The annual expenditure incurred in connection with the institution shall be defrayed out of the provincial treasury."

$100,000 was provided for the erection of the main building. A site was provided by the Dominion Dept. of Militia and Defence on the condition that the College would include military training as a requisite subject in all courses provided. The erection of the main building was proceeded with at once and the College was opened with courses in civil, electrical, mechanical, and mining engineering in the autumn of 1908. Since that time no other departments have been added, but the College has enlarged as the administration centre of a comprehensive system of secondary technical education throughout the province.

Main Building.

The main building of the Technical College, which contains the lecture rooms, science laboratories, museum, library, gymnasium, and assembly hall, was completed in 1909. It is an imposing building of pressed red brick and free stone, erected on the military property adjoining the Court House on Spring Garden Road in Halifax. The main structure is 146 feet long, 48 feet wide, and has two wings, 41 by 52 feet.

In the basement, room is provided for a workshop, fan room, store room, assaying laboratory, balance room, metallography laboratory, locker room, cement laboratory, and gymnasium.

The first floor contains the administration offices, museum, curator's office, geological laboratory, lecture rooms, electrical measurements laboratory, electrical research laboratory, dark room, and heat laboratory.

On the second floor are the staff offices, library, chemical laboratory, chemical research laboratory, lecture rooms, drafting rooms and assembly hall. The building has a steel frame, reinforced concrete floors, and is of slow-burning construction throughout.

Engineering Laboratories.

The main building for the engineering laboratories was erected in 1908. This building, 40 by 160 ft., contains the central power plant, mechanical engineering laboratory, machine shop, materials testing laboratory, and hydraulic laboratory.

During the year 1911 the Murray Laboratory of Mining and Metallurgy was completed and the equipment partly installed. The details of the laboratory and equipment are given in the following paragraphs:

This is a brick, steel, and concrete building, 100 ft. square and two stories in height.

Space has been provided for a sample grinding room, supply room, workshop, lecture room, drafting room, testing laboratory, office, and lavaratory. The main portion of the building consists of one large open space which is devoted to metallurgical and ore dressing processes.

The equipment for sample grinding consists of 1 Braun Chipmunk Crusher, 1 Braun Disc Pulverizer, 1 Braun Rotary Hand Grinder, 1 Allis-Chalmers Type B Sample Grinder, 1 Gates Sample Crusher, Type F. This sample grinding apparatus is driven by an independent 5 H. P., three phase, Westinghouse motor.

The equipment for metallurgy consists of a blast furnace for smelting lead and copper ores, a hand reverberatory roasting furnace, an English cupelling furnace, a copper refining furnace, experimental cyanide plant, a pot roaster, a Bessemer convertor for copper mattes, a small coking oven, etc.

The ore dressing, equipment consists of a coal washing plant as manufactured by the Jeffrey Mfg. Co., for the United States Government Coal Testing Laboratory, 1-7″ x 10″ Blake Rock Breaker, 1 Type O D Gates Gyratory Breaker, 1-5″ Huntington Mill, 1 set 10″ x 12″ laboratory

crushing rolls, 1-6" vertical mill elevator, 1 set standard trommels, 1-2 compartment laboratory Hartz jig, 1 Richards Pulsator jig, hydraulic cone classifiers, 1 half-size Wilfley concentrating table, 1 Standard 4' Frue suspended vanner, 1 James Slime Table, 1-five stamp mill with 450-lb. stamps and Hendy Challenge Feeder, 1 Frenier Sand Pump, 1 magnetic separator, 1 Abbe Ball Mill, 1 oil flotation testing apparatus.

There is installed in the building a model mine plant with a 30 h. p. upright tubular boiler, 1-10" x 10" x 10" Ingersoll straight line compressor, 1-5" x 6" Lidgerwood friction hoist with 10' drum. It is planned to make every student in Mining Engineering thoroughly familiar with these fundamental machines before graduation.

Apparatus for the testing of materials for highway construction is also installed in the Mining and Metallurgical Laboratory. This consists of 1 De Val abrasion cylinder, 1 ball mill, 1 Olsen standard impact testing machine, 1 Olsen Page cementation briquette former, and 1 Olsen Diamond saw.

In this Mining and Metallurgical Laboratory industrial research on the mineral resources of the provinces is carried on as well as the instruction of college students in Mining Engineering.

College Government.

The Governing functions of the Nova Scotia Technical College are vested in a Board of Governors and the Council of Public Instruction. The Board of Governors consists of one member nominated by each of the six affiliated Colleges and universities in the Maritime Provinces together with the professors of the teaching staff of the Technical College.

This Board makes all regulations in regard to admission requirements, general curriculm, and other matters which concern the general standard and welfare of the College. The Board of Governors is under the supervision and control of the Council of Public Instruction, and all regulations made by the former body must receive the ratification of the latter.

Affiliation.

The Nova Scotia Technical College is affiliated with the following universities,—Acadia, Dalhousie, King's, Mount Allison, St. Francis Xavier and St. Mary's. By the terms of the affiliation, the separate universities offer a uniform course in engineering covering the first two years, and the Technical College offers professional courses in several Departments of engineering covering the last two years of a four year course. Students from the separate universities are admitted to the Technical College on certificate without examination under certain conditions enumerated later. The matriculation requirements for entrance into the uniform engineering course of the separate colleges are also uniform and are set forth in the succeeding paragraph.

Admission to the First Two years Engineering Course in the Affiliated Universities

Applicants for admission must have attained the age of 16 years.

The following is an outline of the subjects and the standard or grade in each subject which is required for admission as a regular engineering student:

1. *Arithmetic and Algebra.*

   Arithmetic.
   Algebra, as in Grade XII, or equivalent.

2. *Geometry and Trigonometry.*

   Geometry as in Grade XII, or equivalent.
   Trigonometry: Plane Trigonometry as in Grade XII, or equivalent.

3. *English.*

   As in Grade XII, or equivalent.

4. *French or German.*

   As in Grade XI, or equivalent

5. *History.*

As in Grade XI, or English and Canadian History.

6. One of the following:

(a) *Latin*, as in Grade XI, or equivalent.
(b) *Greek*, as in Grade XI, or equivalent.
(c) Additional work, equivalent to that required for Grade XII, in the language chosen in Subject 4.

Regulation for Students Conditioned in Matriculation.

"No student shall be admitted to the full work of the first year of the engineering course who is deficient in mathematics, or more than one other matriculation subject. Any student who has more conditions than outlined above may enter College and take a combined Arts and Engineering Course, provided that he can satisfy the matriculation requirements of that college. Such a person cannot be considered a regular first year student in engineering, and will require three years of work to complete the first two years of the engineering course. All matriculation requirements must be removed before the student can enter the second year of the engineering course."

In plain language this means that a sharp distinction shall be drawn between the regular student who has passed all matriculation requirements, and a student who has not obtained the required standard. Any student who fails in matriculation examinations in Mathematics, or in more than one subject, will have to take another year in the Academy and pass the Grade XII examinations, or else he may enter College as a conditional student and take up in the first year Arts Course the subjects in which he was conditioned.

It is better for the average student to spread the first two years engineering course over a period of three years, so that he may be better grounded before entering the Technical College and it is earnestly recommended that students should pursue this method.

Admission to the Technical College.

Applicants must have attained the age of eighteen years.

The students who enter the Technical College will be classified as *regular* or *special*. Regular students are those who are full candidates for

degrees, and special students are those who voluntarily, or by reason of not having passed all requirements up to the time of classification, are taking special courses.

Admission to the Technical College will be on certificate from the properly authorized officer of the university at which the student has pursued his first two years of the engineering course. The certificates must state the subjects taken, the marks made in each subject, and the pass mark required at that university in engineering courses. Certificate blanks will be furnished on application to the Principal of the Technical College.

Regular students will be admitted to the Technical College who have secured the required proficiency in *all the courses* of the first two years Engineering Course as hereafter outlined.

Special students will not be permitted to take more than three courses simultaneously if they wish their work to count toward a degree.

Note.—The following temporary exception has been adopted:

Regular students will be permitted to enter the Technical College who are *conditioned in one subject only* of the first two years course, provided that that subject is not one of the following:

Mathematics, Physics, Chemistry, Surveying or Drawing.

The right however, is reserved to exclude as a regular student anyone who has failed in any other subject of the preliminary course than those specified above.

Admission to Advanced Standing in the Technical College

Any person may be admitted to advanced standing in the Technical College by passing such examinations as are deemed necessary by the College faculty, or by submitting such certificates of previous records of study or experience as shall satisfy the faculty. All applications for special examinations for advanced standing must be made to the principal of the college before September.

Any person on the payment of the required fee and the production of evidence to the faculty of sufficient knowledge and training to benefit

by the instruction in any separate class or classes given in the Technical College, may enter and pursue such class or classes as a special student.

Regulations Regarding College Standing.

Any regular student who fails in more than a certain number of subjects at the completion of any semester, may be required by the College Faculty to change his rating to that of a special student and limit his study to three subjects which do not require the subjects in which he has failed as pre-requisites.

Each student is required to actually attend 90% of all lectures, recitations, laboratory and drafting room periods, etc., in order to qualify for permission to take mid-year or final examinations. Special consideration may be extended by the faculty in exceptional cases of sickness, bereavement, etc.

The Faculty may allow students to take supplementary examinations at regularly appointed times in case of failure to reach the required standard of proficiency in any subject during one semester.

In exceptional cases of failure on the part of a student, the Faculty may grant him permission to take a special examination.

The fee for each student for a supplementary examination shall be $3.00 and for a special examination, $5.00.

Any regular student in the junior or senior year who fails to attain the required standard of proficiency in three or more subjects during one semester may, at the discretion of the Faculty, be required to repeat all the subjects in his course for that semester or year before proceeding further as a regular student to secure a degree.

Degrees.

To whomsoever shall satisfactorily acquire the requisite proficiency in all the regular courses of either Civil, Mining, Mechanical, or Electrical Engineering as prescribed in this calendar shall be given by the Technical College a degree of Bachelor of Science in that department in which he has pursued his studies. The degree of Bachelor of Science may also be awarded by the Faculty on the basis of examination alone or for work considered the full equivalent of the engineering courses.

Certificates.

Any one attending one or more classes in the Technical College and attaining the requisite standard of proficiency in said class or classes shall, on application, receive a certificate attesting to the exact work done.

Tuition Fees, Deposits, Etc.

The tuition for instruction in any regular department of engineering shall be seventy-five dollars, ($75) per year, forty dollars of which shall be paid within one month from the opening in September and the remainder during the first month of the second term, which begins usually in February.

To those who are attending special classes the fees are as follows:—

For any single class for one-half year	$ 7.50
" any single class for one whole year, or for two classes for one-half year	12.00
" three classes for one half year	18.00
" four " "	23.00
" five " "	28.00
" six " "	33.00
" seven " "	38.00
" eight or more classes for one half-year	40.00
" seven or more classes for whole year	75.00
Short Courses, each	15.00

An advance deposit of $5.00 will be required of all students taking laboratory classes on entrance to the same to cover breakage or damage to apparatus. An itemized account of supplies or damages will be rendered at the end of year for settlement.

Scholarships.

There is one free scholarship of a value of seventy-five dollars ($75.00) for each of the eighteen counties of Nova Scotia, except the counties of Halifax and Cape Breton, for which there are two free scholarships each. These scholarships are to be awarded on the basis of need and merit after the results of the mid-year examinations. The applic-

ants for scholarships must have been *bona fide* residents for more than three years in the county for the scholarships for which they are seeking. If there is no applicant in any one year for a certain scholarship, a student resident in any other county for more than three years previously may, by permission of the Faculty, apply for the vacant scholarship and may be awarded the same by the Faculty.

First Two years Uniform Engineering Courses in the Affiliated Universities.

Acadia, Dalhousie, King's, and St. Francis Xavier have amended the two years' uniform engineering course in their respective universities. Following is the outline of the amended courses as they will be carried out after September, 1911, in the above colleges:

I. Mathematics—

1. Solid Geometry..... 24 hours.
2. Analytical Geometry..... 48 hours.
3. Calculus: Differential and Integral..... 96 hours.

II. Chemistry—

1. Gen. Chemistry: Lectures..... 72 hours.
2. Gen. Chemistry: Laboratory..... 96 hours

III. English—

1. English Composition..... 48 hours.

IV. Drawing—

Freehand: Mechanical and Machine Drawing..... 240 hours.

V. Physics—(including Mechanics, Electricity, Heat, Light, and Sound.)

1. Lectures and Recitations..... 120 hours.
2. Laboratory..... 120 hours.

VI. Surveying—

1. Lectures..... 48 hours.
2. Field work, Mapping, and Topographical Drawing..... 144 hours.

VII. **Descriptive Geometry—**

Lectures, Recitations and Drawing..... 72 hours.

VIII. **Kinematics—**

Kinematics of Machines..... 72 hours.

IX. **Workshop**.....216 hours.

X. **General Geology**—for Mining Engineering only.

Lectures..... 48 hours.
Laboratory and Field Work..... 72 hours.

Prerequisites.

Students who are entering the Technical College and are deficient in any of the required entrance subjects will not be allowed to take any course for which that subject is a prerequisite.

Any student who wishes to take a special course in the Technical College must have previously passed the course which will enable him to benefit by the advanced instruction. The prerequisites for the regular courses are given in the following table:—

Mechanics of Engineering Mathematics and Physics.
Railway Location.....Trigonometry and Surveying.
Thermodynamics.....Mathematics and Physics.
Advanced Surveying.....Trigonometry and Surveying.
Roads and Pavements....Surveying and Trigonometry.
Machine Design.....Drawing and Kinematics of Machines.
Electrical Machinery.....Physics.
Electrical Laboratory.....Physics.
Applied Geology.....Geology.
Quantitative Analysis.....Chemistry.
Principles of Metallurgy...Chemistry.
Mine Surveying.....Surveying.
Mechanical Engineering
Laboratory.....Kinematics of Machines.
Assaying.....Chemistry.
Mineralogy.....Chemistry and Geology.

If a student, however, wishes to study some special course and does not wish to count this towards a degree he may be allowed to take such course at the discretion of the Faculty of the Technical College upon his presenting a signed statement that he does not wish the work to count towards a degree.

Engineering Camp.

A united engineering camp for students between the second and third and the third and fourth years for civil and mining engineering, will be held in some place to be selected in Nova Scotia, September 10th to October 2nd, 1921. There will be required a deposit of twenty-five dollars ($25) for this class to be paid on entering camp.

Short Courses.

The Technical College offers special short courses each year during the months of January, February and March. These courses are planned for the needs of men in industries who have not had the opportunity to take a full engineering course but who desire special technical instruction in order to advance themselves in their vocations.

Short courses are given in the following subjects:—

Land Surveying.
Steam Engineering.
Machine Design.
Architectural Drafting.
Structural Steel Drafting.
Electrical Machinery.
Coal Mining Engineering.
Metallurgy of Steel.
Technical Chemical Analysis.
Assaying.

A special pamphlet with a full description of the courses will be sent upon application.

School of Navigation.

The Federal department of Marine and Fisheries co-operates with the Technical College in maintaining a School of Navigation for seamen.

The courses of study are adapted for those who wish to obtain government certificates of competency on vessels in inland waters and minor waters, coasting vessels, and deep sea vessels in the mercantile marine. Instruction is given to enable the man with the requisite amount of service to secure a certificate of master for transatlantic liners. The school is open every day except Sunday and every week-day evening except Saturday all the year round. Tuition is free and each person receives individual instruction. Further particulars are set forth in a special pamphlet which will be sent on request.

EQUIPMENT.

A great deal of time and thought has been spent on the equipment for the various laboratories to select a good, thorough, up-to-date assembly of apparatus for teaching purposes. The apparatus as far as it has been purchased already, is given below.

CIVIL ENGINEERING

Surveying Instruments—1 Ainsworth Transit, 3 Gurley Transits, 1 Gurley Mountain Transit, 1 Keuffel & Esser Transit, 1 Cook & Sons Transit, 3 Buff & Buff Transits, 1 Buff & Buff Triangulation Theodolite, 1 Berger Mining Transit, 2 Troughton & Sons Wye Levels, 1 Cook & Sons Wye Level, 1 Keuffel & Esser Wye Level, 2 Gurley Wye Levels, 1 Buff & Buff Wye Level, 1 Buff & Buff Dumpy Level, 1 Stanley Level, 1 Gurley Architects' Level, 1 Zeiss Precise Level, 4 Gurley Compasses, 1 Keuffel & Esser Alidade and Plane Table.

Testing Machines.—One hundred thousand pounds capacity testing machine, extensometer for tension and compression, improved deflection instrument, improved dial deformeter, Gilmour needle, Briquette Moulds, Le Chatelier specific gravity apparatus, Olsen's compression micrometer, encased abrasion cylinder, 2,000 lb. traction dynamometer, 50, 000 lbs. hydraulic compression testing machine, traverse tester of 10,000 lb. capacity, 60,000 inch-pound torsion testing machine.

ELECTRICAL ENGINEERING.

The Nova Scotia Technical College is particularly well equipped with a large amount of up-to-date apparatus and machinery, which is well adapted to the study of Electrical Engineering, located in large, well-designed laboratories and devoted exclusively to experimental and research work.

The electrical laboratories proper are two in number and are located in the main building on the first floor. They are large rooms 43 feet by 23 feet. One is called the Electrical Machinery Laboratory and the other the Electrical Measurements Laboratory. In the Electrical Machinery Laboratory are motors and generators both direct and alternating current, covering almost all varieties and types of commercial machines. Among these are included the following:

One Fairbanks motor generator set, compound wound, consisting of two similar 220-volt D. C. 5 H. P. machines, either of which can be run as a motor driving the other as a generator.

Three Canadian General Electric direct current motors of 5 H. P. capacity and rated at 110 volts. These three machines are identical in size and differ from each other only in the method of field excitation, one being shunt wound, another compound and the other series wound. These machines are arranged so that any two can easily be directly connected together, one being used as a motor to drive the other as a generator, and in this way a study can be made of any of those machines either as motors, as generators or any one of them can be run as a motor by itself and tests for brake H. P. can be made upon it.

Three Canadian General Electric 7.5 K. V. A. alternating current generators with the armature connections brought out so that they can be connected for single, two, three or six phase, and also either star or delta. These machines are supplied with extra rotors and by changing rotors, can be used as alternating generators, synchronous motors, induction motors with squirrel cage rotors or induction motors with wound rotor. They also are identical in size and are so arranged that any two can be directly connected together or any one can be separately driven by a 10 H. P. direct current motor.

One Westinghouse special laboratory rotary convertor with six slip-rings and with a direct current rating of 30 amperes at 250 volts. This machine can be run either single, two or three phase.

One 10 H. P. three phase 220-volt induction motor.
One 10 H. P. 220-volt D. C. motor.
One 5 H. P. single phase induction motor.
One Lincoln variable speed D. C. motor.

There are also a variety of small (fractional horse-power) single phase motors covering all types from the straight single phase motor to repulsion motors.

This Laboratory contains a special Laboratory 2-Panel switchboard, by means of which Direct-current or single and three-phase A. C. can be plugged to any test table in either Laboratory. A great variety of connections are made possible by the arrangement of this board. One panel carries the socket-ended connections to all tables and Laboratory circuits and the other carries all switches, circuit-breakers and meters for the control of 64 cell storage battery in the basement.

Observations on the various machines under test are facilitated by test tables with panel backs, which carry all switches, breakers, etc., necessary for the use of ammeters, voltmeters and wattmeters, in the circuit of the machine.

Alternating current may be converted to direct current for charging small batteries, etc., by a C. G. E. Co's standard 10-amp. mercury arc rectifier panel in this Laboratory.

The instrument closets in this laboratory are equipped with a large variety of portable electrical instruments, both alternating and direct current, covering all kinds and ranges of ammeters, volt-meters, wattmeters, speed meters and testing sets.

Loads for generators under test are provided by lamp banks on the walls, a water barrel rheostat and a water tank rheostat arranged to provide a three phase load when necessary.

The Electrical Measurements Laboratory.

This laboratory is used for delicate electrical tests which require accurate and careful work, freedom from disturbance and vibration. In this laboratory are kept a full equipment of precision and standard meters for the calibration of electrical instruments among which, besides Siemens-Halske standard voltmeters, ammeters and watt-meters, are included a Leeds Northup potentiometer with all necessary accessories for voltage, current and resistance measurements. Several Wheatstone bridges, a variety of ballistic and non-ballistic galvanometers also a full range of standard resistances and resistance boxes. There is also in this laboratory one General Electric oscillograph, which is mounted on special brick pillars to insure freedom from vibration, this machine being used for the study of alternating wave shapes and the effects of all kinds of disturbance in electric circuits.

A 20 K. V. A. high voltage transformer 100 to 30,000 volts, is set up in this room and is used for the purpose of testing the insulating qualities of various insulating materials, and to demonstrate methods of performing wet and dry arc-over tests on commercial line insulators.

The laboratory is equipped with heavy steel frame tables with polished marble tops, and with its excellent equipment affords splendid opportunities for careful experimental or research work.

Power Supply.

Power for laboratory work can be obtained from three sources, and at all times an adequate supply of direct or alternating current, single or three phase, can be obtained.

Alternating current is obtained from the Nova Scotia Tramway and Power Company, in the form of 220-volt three-phase or 110-volt single phase power. This can again be converted by means of two permanently connected motor generator sets in the Electrical Machinery Laboratories, into direct current at 110 or 220 volts.

Direct Current can be obtained from a 50 K. W. 3 wire direct current generator, 220-110 volts, located in the Nova Scotia Technical College Power House, and which is directly connected to a Robb automatic cutoff 10" x12" high-speed engine. This set is wired so as to supply direct current to the laboratories and also light and power to all the college buildings. Direct current for the laboratories or for other purposes can also be obtained from a 200 ampere hour, 64-cell storage battery located in the basement of the main building. This battery is particularly useful for tests where a steady, unvarying source of power is necessary.

The laboratories also contain samples of all the more common electrical appliances in general use, such as wiring fixtures, sockets, condulets, switches and different kinds of insulated wires and cables, arc lamps, telephones, telegraph instruments, dry and wet batteries, scales, balances, micrometers, machinists and electricians' tools, fuses and spare and repair parts for many of the machines and appliances.

None of the apparatus is cheap or unreliable, some of the precision meters being the best on the market, while the others are all standard commercial types. The students are free to use any or all of the equipment under proper direction when they are sufficiently advanced in their studies to do so intelligently.

MECHANICAL ENGINEERING.

The equipment and various units used by the Mechanical Engineering Department are located in the Engineering Laboratory, a large brick building 154 feet long by 40 feet wide, running approximately north and south, situated a short distance from the east end of the main college building.

This large and well lighted Laboratory is divided into four divisions; the Steam Engineering Laboratory, the Hydraulic Laboratory, a modern machine shop and the Materials of Testing Laboratory; the Hydraulic Laboratory being used also in connection with the other branches in which it is specified, as well as the Materials of Testing.

In the Steam Engineering Laboratory, power is developed and supplied by two H. R. T. boilers of 80 H. P. each, which also supply heat to all of the college buildings and residences. These are hand fired, natural and forced draft, and may be fed by either injectors or feed pump. These boilers are equipped with the necessary draft gauge connected at the various points, where measurements of draft are required, pyrometers for ascertaining the temperature of the flue gases, CO_2 recorders, hydraulic gas sampler and in fact all equipment for complete testing of boilers.

It might be noted here that all of the returns from the heating systems are fed back automatically to the boilers through a series of Bundy steam traps.

In the pump room there is a Cochrane open heater and feed pump with weighing apparatus to measure feed water supplied to the boilers when running a trial.

Coming up from the boiler room, which is on a lower level then the main floor, are found the following units:

One Automatic high speed steam engine, manufactured by International Engineering Works, (formerly the Robb Engineering Company,) size 10″ by 12″, 75 H. P., direct connected to a 3-wire generator. This engine can exhaust to atmosphere, to heater or condenser, so that the unit can be tested operating, condensing or non-condensing, as may be desired.

One horizontal cross-compound non-releasing Robb Corliss automatic cut-off engine with cylinders 12″x 20″ and stroke 20″, having expecially wide range of adjustment of governor and valve gear, and built by the International Engineering Works of Amherst, N. S. This engine is designed for a normal load of 150 H. P. non-condensing to about 220 H. P., condensing at 180 R. P. M. On the L. P. side the shaft is extended through the bearing carrying a flange-coupling for direct connection to a dynamometer, generator or other load. In addition, the main pulley, which serves also as a fly-wheel, is equipped with a water cooled brake as made by the Westinghouse Machine Company, of ample capacity to absorb the full power of the machine. This engine may be operated either condensing or non-condensing and is fitted with all the apparatus required for testing.

One 10 H. P. horizontal engine, medium speed, balanced slide valve throttling governor, manufactured by James Leffel and Company, espec-

¡ally equipped for valve setting and simple testing.

One vertical 8 H. P. Engine, manufactured by I. Matheson and Company, marine type, throttle governing, medium speed, with piston valve, equipped for testing.

One Fore and Aft Naval type Compound Engine, size 8″ x 6″ x 11½″, fitted with piston and trick valves and direct driven pumps. May be used with keel or surface condensation. One Yarrow water tube boiler with Donkey pump and manifold connection for bilge, sea or fresh water boiler feeding.

One Kerr steam turbine, 20 B. H. P. at 3600 R. P. M., equipped for measuring pressure in the different stages, and also with extended shaft through outboard bearings carrying a flange coupling for connecting to dynamometer or other loads.

One DeLaval turbine, 7½ H. P., at 30,000 R. P. M. reduced to 3000 R. P. M., and direct connected to a No. 3 Sturtevant High Speed blower, with spare parts for demonstrating purposes.

One 9½ Canadian Westinghouse steam driven air compressor, locomotive type, equipped with automatic cut-out and connections for the measurement of work done and air supplied, and also a pressure tank with orifices of varying sizes, and guages.

One Westinghouse surface condenser, three pass, having 350 square feet of cooling surface and mounted on stanchions over independent steam driven vacuum pump. One Sims Heater, containing 87 square feet of cooling surface, so installed that it may be used as a surface condenser at atmospheric pressure. This heater can be used for any of the smaller units when it is desired to measure the steam consumption under atmospheric conditions.

One Blake Knowles duplex steam pump, size 10″ x 6″ x 10″, boiler feed type, equipped for indicator connections both for cylinders and valve chest This pump receives its supply from a large concrete tank below the floor level and discharges into pressure and measuring tanks, and also forms part of the Hydraulic Laboratory equipment.

Three Fairbanks Morse steam driven duplex pumps, size 3″ x 2″ x 4″. One of these pumps being sectionalized for demonstration purposes, while the others are mounted for testing.

One Froude Patent Hydraulic Brake, size No. 2, manufactured by the Heenan and Froude Company, Limited. Max. B. H. P. 250 at 300 to 3000 R. P. M., mounted so that it may be moved to and connected to any of the units.

The smaller apparatus contained in the M. E. Department consists of the following:

One Boys standard gas calorimeter with pressure regulator and meter.
One calorimeter for measuring the temperature of steam at various pressures.
One Parr calorimeter for determining the calorific value of coal.
One total carbon apparatus for the proximate-analysis of coal.
One Ellison Throttling evaporating calorimeter for obtaining the dryness of steam.
One Carpenter's separating calorimeter.
One Barrel calorimeter.
One Hay's flue gas analysis apparatus complete.
One Crosby dead weight gauge tester.
One Engler Viscosimeter.
Two Crosby continuous steam indicators.
One improved reducing apparatus for indicators.
Two sets of standard Crosby steam indicators.
One set of standard Crosby gas engine indicators.
Apparatus for determining the heat radiation of bare and covered pipes, radiators, etc.

An ample supply of guages for steam and water weighing devices, speed counters, tachometers, prony brakes, springs, thermometers, etc., are kept on hand to be used as called for by the various tests.

The second division of the Engineering Laboratory contains the machine shop, which occupies about one-half the floor space of the building and is considered one of the best shops that can be found either in commercial work or in training centres. The equipment contained in this department is as follows:

One Ford Smith No. 2 Universal Milling Machine, fully equipped for gear cutting, both helical and straight tooth gears, of diameter up to 36". A full set of gear cutters, surface mills keyway cutters, saws, Woodworth key seaters, reamers, drills, etc., are available for this machine.

One Le Blond precision machine for surface grinding, both internal and external, with full cabinet of various attachments for grinding reamers, taps, milling cutters, etc., and case-hardened or tempered work.
1 MacDougall 20" shaper.
1 Ford Smith No 20 wet tool grinder presenting a face of 2½".
1 Gas oven for case hardening or tempering tools and cutters.
2 Le Blond 16' x 6" engine lathes with quick change gears and taper attachments.
2 18" x 7" Boy & Emmes engine lathes with standard equipment and quick change gears.
3 C. M. C. engine lathes, 10" x 6 feet, with quick change gears, draw in collets and turret attachments.
1 Davenport 22" x 12" engine lathe with quick change gears and compounded back gearing.
1 engine lathe 16" x 6' manufactured by the Preston Machine Company.
1 Gap lathe ranging from 22" to 38" swing with 14' led and quick change gears.

1 screw cutting lathe 16" x 6', with taper attachments and draw in collets.
1 C. M. C. engine lathe 18" x 8' with quick change gears.
1 Vertical Drill Press, size 30", manufactured by John Bertram & Sons.
2 Oster Pipe Threading machines, from ¼" to 4".
1 Radial Drill with a working arc of 3', tilting table, automatic knock out feed, reversible spindle, quick change gears for various spindle speeds and may be used for drilling or tapping.
2 Drilling Machines, bench type, for small drilling and centering work.
1 Bertram Planer, 8' x 30".
1 Power Hack Saw.
1 Oil filtering and measuring tank.

The tool room for this shop is as completely equipped as the shop demands, with jigs, fixtures, tools, tool holders, drills, taps, dies, reamers, wrenches, hammers, chisels, and assortments of bolts and nuts and other small items necessary to keep all the machines in operation at the same time on any class of work.

There is also contained in the tool room one small tool makers' lathe, for extra fine work.

Power for driving these machines is obtained from 4 separate line shafts driven by 4 motors.

Power for driving these machines is obtained from four A. C. motors, belted to four separate line shafts, and these being in turn belted to the various countershafts.

The training given in this department is strictly in accordance with modern machine shop practice, where accuracy, neatness and skilful manipulation of the hand tools and machines are firmly impressed on the students.

The Hydraulic Laboratory, making the third division, contains the following equipment:

One Blake duplex steam driven pump which has been mentioned.
One turbine pump, size 2", manufactured by John McDougall and Company. Direct connected to a 5 H. P. continuous current motor.
One centrifugal pump, direct connected to a 5 H. P. motor.
One Pelton Water Wheel, 18" rotor.
One No. 4 Gould Hydraulic ram.

One large pressure tank, fitted with guage and water glass and capable of standing a pressure of 200 lbs. sq. in. used for obtaining a pressure head on the pumping apparatus.

One large measuring tank equipped with water glass and quick emptying valves.

One elevated tank with automatic supply for keeping constant head when desired, on water flowing through orifces.

One long elevated steel tank fully equipped with the standard and notch rectangular and circular weirs, hook gauge, screens for retarding the velocity of the water, and regulating device for keeping constant heads.

This tank is connected to the measuring tank so that co-efficients of discharge may be obtained.

Two Venturi meters of size 1" and 3", as manufactured by the Builders Iron Foundry, with common mercury column arranged on line to measuring tank. This system of open and pressure tanks are so piped and bypassed that they are all connected and drain back to the large concrete tank from which the main pump receives its supply.

Besides the above mentioned there are various piping arrangements for the measurement of lost head due to friction in pipes, water hammer, and loss due to bends and various standard angle and valve fittings.

In the last division is found the Materials Testing Laboratory, and it contains the following machines:

One 100,000 lbs. capacity Tinius Olsen Universal Testing machine, electrically driven and fully equipped with autographic apparatus, capable of testing a beam 17 feet long or a column 6 feet high, and especially adapted to tension, shearing, and compression test of standard steel specimens. There is a full assortment of the latest extensometers and compressometers for wood, metal or concrete, and other measuring devices.

One 50,000 lbs. capacity hydraulic compression machine, hand operated, used chiefly for small compression tests.

One 60,000 inch pounds torsion machine, electrically operated.

One 10,000 lbs. capacity transverse testing machine, hand operated, capable of testing beams 12 feet long.

For all of these machines there is a full equipment of measuring instruments and standard attachments for all methods and kinds of testing.

Included within the M. E. Department is the Gas Engine Laboratory, which is situated in a section of the Mining Building,—it contains the following equipment:

1 Crossley Oil Engine of 4 H. P., hot tube ignition, which may be operated with various fuels.

1 Fairbanks Morse 4 H. P. horizontal, 4 cycle gas engine, make and break ignition.

1 vertical 12 H. P. 2 cycle single cylinder stationary type gas engine, used with kerosene or gasoline, belted to a Reavell Duplex air compressor.

1 Vertical Fairbanks Morse kerosene engine of 6 H. P.

1 5 H. P. Acadia Gas Engine, marine type. These engines are fitted with pulleys for B. H. P. tests and are cooled by circulating water from a measuring tank. All necessary connections for measuring fuel consumption, thermal efficiency, etc., are provided.

DEPARTMENT OF CIVIL ENGINEERING.

The course in Civil Engineering covers four years of prescribed studies. The first two years are given at the affiliated colleges, covering the basic subjects which are common to all branches of Engineering. The third and fourth years are given at the Technical College, and the whole course is designed to give the student sound training, both theoretical and practical, in the subjects on which professional practice is based.

Civil Engineering is the broadest in scope of the Engineering professions, being the parent stem from which have diverged the other branches, but even though these have been recognized as distinct professions, the field of Civil Engineering still remains so large that no one can become expert in all its subdivisions. All branches rest, however, upon a relatively compact body of principles, and in these principles the students are trained by practice in class-room, the field and the laboratory.

The professional work begins in the third year with the study of Highway Engineering, Railroad Engineering, Advanced Surveying, Strength of Materials and Elementary Structures. The outlook of the student is further broadened by courses in Mechanical and Electrical Engineering. In these courses the student is shown the application of Geometry, Trigonometry, Calculus, Physics and other branches.

The fourth year is devoted almost wholly to professional subjects and the student is led into the details of Structural Steel and Reinforced Concrete design, Hydraulic Engineering, Sanitary and Municipal Engineering and other branches. In this year, especially, the student is expected to be able to apply intelligently to practical problems the principles that he has studied. The object of the course is to give mental power, to avoid rule of thumb methods, and to train the student to have courage and self-reliance in solving the problems an engineer has to meet.

101—Mechanics of Engineering I.

Third Year, Civil, Electrical, Mechanical and Mining Engineering, First Semester, Five Hours per Week.

This course comprises a study of the principles of Statics, including the determination of reactions; of distributed forces, centre of gravity; of moment of inertia and radius of gyration of plane areas and solids; of kinematics and kinetics, including the equations for uniform and varying rectilinear and curvilinear motion, centrifugal force, falling bodies, unresisted projectile, the pendulum, harmonic motion, rotation, combined rotation and translation, linear and angular momentum, impact, work, power and kinetic energy.

Text—*Wright*—"Elements of Mechanics."

102—Mechanics of Engineering II.

Third Year, Civil, Electrical, Mechanical and Mining Engineering, Second Semester, Three Hours per Week.

This course comprises a study of the strength of materials, stresses and

deformations in bodies subject to tension, compression or shear; stresses due to torsion, the study of riveted joints, the common theory of beams with a thorough discussion of the distribution of stresses, the calculation of shearing forces and bending moments, slopes and deflection; stresses in hooks, in columns; stresses in composite beams including reinforced concrete; stresses in springs.

Text—*Boyd*—"Strength of Materials"

103—Materials Testing II.

Third Year, Civil, Electrical, Mechanical and Mining Engineering, Second Semester, Three Hours per Week.

A course of fifteen laboratory exercises so arranged to illustrate the principles of the lecture course given by Mechanics of Engineering II, No. 102, and includes the following: Tension tests of various materials in 50 and 25 ton testing machines; determination of stress strain diagrams by extensometers, scales and automatic recorders; deflection of beams, wood and metal; torsion of shafts; determination of Young's modulus for various materials; the efficiency of welded and riveted joints; together with demonstrations on the testing machines of tensile tests of various materials, the destructive tests of timber, reinforced concrete beams and small columns, the compressive strength of concrete, bricks, mortars, and stone.

105—Structures I.

Third Year, Civil Engineering, Second Semester, Two Hours per Week.

This course is designed as an introduction to the study of Structures as given in the fourth year. It comprises a study of the loads usually carried by Railroad Bridges, Highway Bridges, Roof Trusses, Steel Buildings and other structures: the computation of reactions, shear and moment for the different systems of loading, the calculation of maximum shear and moment for a set of moving loads, the use of the influence line, the design of simple beams.

Text—*Spofford*—" Theory of Structures."

106—Structures—I-A.

Third Year, Electrical and Mechanical Engineering, Second Semester, Two Hours per Week.

This course is designed for the needs of those who do not take the advanced

work in Structures; it covers the computation of reactions in statically determinate structures, the calculation of stresses in simple trusses, the design of simple trusses of both wood and steel, the design of beams of wood, steel and concrete.

Both the analytical and graphical methods are used and the student is familiarized with the use of the steel hand book. No text is prescribed.

111—Theoretical Hydraulics.

Fourth Year, Civil, Electrical, Mechanical and Mining Engineering, First Semester, Three Hours per Week.

This course covers the principles of hydrostatics, effects of translation and rotation upon bodies of water; fluid motion, Bernoulli's Theorem, discharge from orifices, flow through mouthpieces, flow over weirs, flow through pipes, flow in open channels.

Hydraulic motors, turbines, etc., are taken up in the course in Water Power Engineering.

Text:—*Russell*—"Hydraulics".

112—Hydraulic Laboratory.

Fourth Year, Civil, Mechanical, Electrical and Mining Engineering.

A course of fifteen laboratory exercises of three hours each, in the first semester of the fourth year, running concurrently with course No. 111. This course can best be illustrated by the following list of tests made by the students during the past few years.

Calibration of Measuring tanks.

Test to determine the coefficient of discharge of water through orifices.
" " " " " " " for a triangular weir.
" " " " " " " " rectangular weir
" " " " " " " " circular weir
" " " " efficiency " nozzles
" " " " " " a turbine pump.
" " " " " " centrifugal pump.
" " " " " " Pelton water wheel.
" " " " " " an Hyrdaulic Ram.
" " " " loss of head due to friction in pipes.
" " " " water hammer in pipes.
" " " " loss of head due to angles and bends in pipe lines.

The study and calibration of Venturi and other water meters.

119—Advanced Surveying I.

Third Year, Civil Engineering, First Semester, Four Hours per Week.

Chiefly devoted to a consideration of various methods of conducting topographic and hydrographic surveys, and includes: *Triangulation*—Systems of triangulation, base line, and instruments for measuring same, corrections, instruments for measuring angles, reduction to centre, adjustments for triangulation, computations, three point problem. *Precise Levelling*—Sources of error and instruments. *Trigonometric Levelling*—Simultaneous observations, refraction co-efficients, observations at one station, rough computations. *Barometric Levelling*—Barometers, and their use, calculating heights, corrections, formulae, etc. *Stadia*—Theory of Stadia, formulas, fieldwork, uses of tables, diagrams, and stadia slide rule. *Plane Table Meihod*—Instruments and their adjustments, locating points by intersection, resection, three point problem and two point problem, elevation and distances. *Hydrographic Surveying*—Shore line surveys, principle, use and adjustments of sextant, subaqueous surveys, locating soundings, etc., map, projections, constructing and finishing map. The mapping of surveys made at the previous summer camp will be completed.

Text—*Breed and Hosmer*—"The Principles and Practice of Surveying". Vol. II.

120—Advanced Surveying II.

Third Year, Civil Engineering, Second Semester, Five Hours per Week.

A continuation of course 119, involving the principles of practical astronomy, astronomical definitions, the astronomical triangle, conversion of time, determination of latitude, longitude, azimuth and time with ordinary surveying instruments, theory and use of solar transit and solar ephemeris.

121—Railroad Engineering I.

Third Year, Civil Engineering, First Semester, Three Hours per Week.

This course consists of a thorough study of the mathematics of simple, compound and reversed circular curves, the parabolic curve, the spiral easement curve, with particular reference to their application in Railroad and Street work, a study of frogs, switches, sidings, tracks, ladder tracks and yard layouts.

Text—*Allen*—"Railroad Curves and Earthwork".

122—Railroad Engineering II.

Third Year, Civil Engineering. Second Semester, Three Hours per Week.

A continuation of course 121, with particular reference to methods used in staking out and computing earthwork, haul and overhaul. Both the analytical and graphical methods of computation are used. A series of lectures is also given on signalling, train resistance, and the influence of grades, distance, curvature, rise and fall, yards and terminals.

Text—*Allen*—"Railroad Curves and Earthwork."

Reference—*Raymond*—"Elements of Railroad Engineering".

123—Summer Surveying Camp.

Third Year, Three Weeks preceding First Semester, Civil and Mining Engineering.

Three weeks field work is carried on in camp in September, preceding the third year. This object is to give the students more extended field practice than is possible during the regular college year. It is the intention that each student shall be given ample practice with all the instruments used. The work usually done by those entering the third year consists in running transit lines for the preliminary survey of a short railroad line; in running level lines on the same survey and taking the topography by means of the hand level and stadia. The third year men also act as rodmen and chainmen on the more advanced work carried on by the fourth year men. Each student is required to keep full sets of notes from which the surveys are plotted.

Students should provide themselves with blankets and bedding. A fee of $25.00 is required to cover the cost of board while at camp. Application to take the course should be sent to the Secretary of the College, not later then August 15th.

124—Summer Surveying Camp.

Fourth Year, Three Weeks preceding First Semester, Civil Engineering.

This is a continuation of course 123, in which those entering the fourth year apply the principles studied in courses 119, 120, 121 and 122. On the preliminary survey made by the third year students, a railroad line is plotted and then run in on the ground, a profile is made and grade calculated.

The line is then cross-sectioned and the quantities computed, overhaul figured and the cost estimated. Topographic work is also carried on by means of the stadia and plane table. From a carefully measured base line, a system of triangulation is developed for control in plane table work. Stream gauging is carried on by means of floats and current meters. Students should provide ,themselves with blankets and bedding. A fee of $25.00 is required to cover the cost of board in camp. Application for this course should be in the hands of the Secretary of the College by August 15th.

131—Highway Engineering.

Third Year, Civil Engineering, First Semester, Two Hours per Week.

This course takes up the study of approved practice in the construction of roads and pavements and of the principles involved. The Highway Laboratory is also taken in connection with this course since the problem involves the selecting and testing of materials. This course opens with a brief historical outline of the development of roads and pavements, and then proceeds to the study of the various classes of roads and pavements, including: earth roads, gravel roads, water-bound macadam roads, concrete roads, wood and stone block pavements, bituminous roads and pavements, sheet asphalt and asphalted concrete surfaces, selection of types, surveys, specifications and estimates.

132—Materials Testing I.

This course runs concurrently with No. 131, and comprises all the tests used in present practice to determine the suitability of rocks for road building purposes. The tests are all devised with the aim of ascertaining the behavior of materials under service conditions, and include the test for specific gravity, hardness, toughness, binding power or cementing values, and compression. Facilities are also provided for testing Paving Bricks and Blocks.

141—Masonry and Foundations.

Fourth Year, Civil Engineering, First Semester, Three Hours per Week.

This course is devoted to the study of materials used in masonry construction and the various tests for the same. Stability of masonry structures, design and calculations for various types of foundations, treatment of soils, tall chimneys and towers, underpinning, theory of earth pressures, retaining walls, masonry dams, and the masonry arch.

Text—*Baker*—"Masonry Construction".

142—Materials Testing III.

Fourth Year, Civil Engineering, First Semester, Three Hours per Week.

Given concurrently with No. 141. The work consists of standard tests of cement, cement mortars, and concrete. The student is taught to make use of the Standard Methods of testing in order that he may gain a knowledge of those methods, that his results may be compared with the results obtained by other experimenters, and that his results may be of the greatest possible practical use in his own engineering practice. After working through the standard tests, the student is given every encouragement to launch into research work, for which there is still a big scope in concrete construction.

143—Masonry Design.

Fourth Year, Civil Engineering, Second Semester, Three hours per Week.

One drafting period per week is devoted to the design of masonry and reinforced concrete structures. Masonry dams, retaining walls and footings are among the structures considered and the analytical and graphical methods are both used. Care is taken to avoid rule of thumb methods and the student is expected to apply intelligently the principles studied in Courses 141 and 178.

151—Public Water Supplies.

Fourth Year, Civil Engineering, Second Semester, Three Hours per Week.

In this course are taught the fundamental principles of Public Water Supplies, including types of construction. A complete design and lay-out of distributing mains for an average size city is also studied in detail, the students applying the principles of hydraulics, previously studied. The subject matter taken up includes: *Requirements and Resources*, (a) quantity of water required, source of supply. (b) quality of water supplies. *Construction of Water Works*. (a) Works for the collection of water. (b) Works for the purification of water. (c) Distributing System.

152—Hydraulic Design.

Fourth Year, Civil Engineering, Second Semester, Three Hours per Week.

In this course an example of a water power project is studied in detail, the student is given data actually collected in the field and is taught how to use this to make a complete report with accompanying plans.

153—Hydraulic Engineering.

Fourth Year, Civil, Mechanical and Electrical Engineering, Second Semester, Three Hours per Week.

This course embraces a detailed study of stream flow, power of a stream as affected by flow, pondage and storage, study of the power of a stream as affected by head, earliest types of water wheels, turbine details and appurtenances, hydraulics of the turbine, commercial constants, turbine testing, turbine analysis and selection.

Text—*Mead*—"Water Power Engineering".

References: *Hoyt and Grover*—"River Discharge".
Dougherty—"Hydraulic Turbine".

162—Sewerage and Sewage Disposal.

Fourth Year, Civil Engineering, Second Semester, Three Hours per Week.

This course is divided into two parts.

Part 1 includes the design, construction and maintenance of sewerage systems. The following divisions of the subject are studied in detail: The system, amount of sewerage, flow in sewers, flushing and ventilating, collecting the data, the design, detail plans, specifications, contract, and estimate of cost; types of construction, maintenance.

Part 2 includes the study of the various methods of sewage disposal. The problem is taken up from the time of disposal by dilution, and traced through its various stages to the present day. The lay-out of an up-to-date sewerage disposal plant is also studied in detail. Some of the methods studied are: Chemical Precipitation, Septic Process, Treatment in two story tanks, Broad Irrigation, Intermittent Filtration, Contact Beds, Percolating Beds, and the Activated Sludge Process.

Texts— *Folwell*:—"Sewerage."
Kinnicutt, Winslow and Pratt:—"Sewage Disposal."

163—Sewer Design.

Fourth Year, Civil Engineering, Second Semester, Three Hours per Week.

This course runs concurrently with No. 151 and No. 162. The student is given all the preliminary information for the design of a sewerage system for a small town. From these notes the system is laid out, sizes and grades of sewers determined, plans and profiles plotted.

174—Structures II.

Fourth Year, Civil Engineering, First Semester, Three Hours per Week.

This is a continuation of course No. 105, and treats of the computation and design of structures of wood and steel by analytical methods. The subjects considered are: the plate girder, roof and bridge trusses of various types, including trusses with secondary web members and with multiple web members, stresses in trestles of wood and steel, stresses in portals.

Text—*Spofford*—"Theory of Structures".

175—Structures III.

Fourth Year, Civil Engineering, Second Semester, Three hours per Week..

A continuation of course 174, including the study of cantilever bridges, three hinged arches, the design of columns and tension members of trusses, pin and riveted truss joints. Special attention is paid to the computation of maximum stresses in truss members by graphical methods. The student is continually referred to contemporary technical journals for examples of actual practice.

Text—*Spofford*—"Theory of Structures".

176—Structural Design I.

Fourth Year, Civil Engineering, First Semester, Nine hours per Week.

A drafting room course of three periods per week in which the student applies the principles studied in Course 174, and runs concurrently with that course. Each student is assigned a different problem and his work criticized as it progresses.

177—Structural Design II.

Fourth Year, Civil Engineering, Second Semester, Nine Hours per Week.

A continuation of course 176 and running concurrently with course 175. The work covered in courses 176 and 177 usually consists of the design of a plate girder, a wooden truss, a riveted or pin connected truss and a design in reinforced concrete.

178—Reinforced Concrete.

Fourth Year, Civil Engineering, First Semester, Two Hours per Week.

This course is devoted to the theoretical and practical principles underlying the design of reinforced concrete structures. It includes a study of the simple and continuous reinforced concrete beam, the design of slabs, T beams, columns, footings, reinforced concrete retaining walls and dams.

Text—*Hool*—"Reinforced Concrete Construction", Vol. I.

500-501-502-503—MILITARY TRAINING.

Third and Fourth Years, Civil, Electrical, Mechanical and Mining Engineering, First and Second Semesters, Two Hours per Week.

According to the terms of the gift, from the Department of Militia and Defence, of the site upon which the Technical College is built, the College contracted to require specific military training as part of the course of every student aspiring for a degree. Before the recent war the instruction on this subject took the form of military science and drill, but not under a syllabus of training that was recognized by the government; consequently, the student attained no recognized military status. During the war this course was discontinued, because there were practically no students in attendance and these few were physically unfit for service.

After the war it was thought advisable to revise the course, so that the training given might lead to a definite goal, viz., that of qualifying for a commission. It was, therefore, decided to organize a company of the Canadian Officers Training Corps to be known as The Nova Scotia Technical College Contingent.

The course as now given is conducted under the Regulations for the Canadian Officers Training Corps as prescribed by the Department of Militia and Defence.

The syllabus of training requires that all candidates for commissions must have attended at least forty instructional parades, have completed a course in musketry and have passed both practical and written examinations. Upon attaining this standard the student receives Certificate A which entitles him, if he so desires, to be placed upon the list of the Canadian Reserve of

Officers as a Lieutenant. By attending twenty-five additional parades (not in the same year) and passing further examinations he can obtain Certificate B which entitles him to the rank of Captain. If he receives either certificate he is placed on the Reserve List of officers in the Militia, but there is no compulsory service involved in this either in peace or war.

At the Technical College the student during the first year will perform the required number of parades and complete the course in musketry. In the second year he will take up the more advanced work required for the written examination leading to Certificate A. Any student who takes ordinary interest in his work should be able at the end of his second year to pass the required examination and obtain Certificate A. Any students showing sufficient interest and ability, will during their second year, be given the necessary instruction to enable them to qualify for Certificate B. The course requires of the student little or no home work and it is not intended that it should take up any time which might otherwise be profitably devoted to the more strictly engineering studies in which he is engaged.

Members:—The C. O. T. C. forms no part of the organization for war and will not be called out for active service as a corps. In case of a "levee en masse" its members are liable to military service under the Militia Act in the same way as all other male inhabitants of Canada.

Training:—The training of the C. O. T. C. is under the direction of the General Staff Officer of the District. Each unit will be trained by its own officers.

Uniforms, Arms, Equipment and Books:—All necessary uniforms, arms, equipment and books will be provided without expense to the student.

Musketry:—A twenty-five yard gallery practice range has been provided in the Mining Building at the Nova Scotia Technical College. The use of a service range at either McNab's Island or Bedford can be obtained when required.

Military Committee:—A Military Committee is appointed consisting of the following:—

President—Dr. F. H. Sexton, Principal of the Nova Scotia Technical College.

Members—Colonel W. B. Anderson, G. S. O., M. D. No. 6.
Capt. J. F. Lumsden, Professor Electrical Engineering.
Capt. W. G. Hardy, Asst. Prof. of Civil Engineering.

The duties of the committee are to co-ordinate the work of the Contingent with that of the College generally; to administer and control the expenditure of funds of the contingent (from whatever source derived); and to arrange for the theoretical instruction of officers and members of the contingent, by a course of lectures on military subjects.

600—Technical Writing.

Third Year, Civil, Electrical, Mechanical, and Mining Engineering, Second Semester, One Hour per Week.

The aim of this course is to train the engineering student in the special application of English composition to such demands as will be most frequently made upon him in practical life. He is supposed to be familiar with the rules and practice of general composition and to be acquainted with some portion of good English literature. In this course the main stress will be laid upon the proper preparation of technical reports, articles for technical magazines, specifications, papers for professional societies, patent specifications, and other such literary efforts as frequently fall to the lot of the professional engineer.

Text—*Sypherd*—"Handbook of English for Engineers."

601—Engineering Law.

Fourth Year, Civil, Electrical, Mechanical, and Mining Engineering, Second Semester, One Hour per Week.

This course covers the general subjects of preparing specifications and the law of contracts. It is taught in lectures by a prominent jurist of the province, and aims to acquaint the student with the fundamentals of the Law of Contracts, especially those portions of the common law that should be familiar to the practising engineer. References are given to standard authorities by the lecturer.

Text—*Allen*—"Engineering Law."

602-603—Social and Industrial Economics.

Fourth Year, Civil, Electrical, Mechanical and Mining Engineering, First and Second Semesters, Two Hours per Week.

The rapid spread of various theories of political economy and the new emphasis that has recently been placed on many revolutionary ideas, make

it necessary for the young engineering graduate to have a knowledge of economics which will form a basis of opinion and action in practical life. The attempt will be made to give the student a broad view of modern political economy without delving into its historical development or stressing too much some recent crudescences that time has not levelled to their proper relative importance. In addition to political economy, special lectures will be given in scientific management, industrial relations, representation of labor in management, engineering salesmanship, corporation accounting, analysis of financial statements, etc.

Early stages of industrial development, industrial evolution in England and North America, utilities and goods, law of diminishing utility, demand, economy of spending and saving.

Evolution of methods of production, factors of production, saving and capital formation, production and sacrifice, cost of production and expense of production, separation in ownership and organization of factors, the entrepreneur, division of labor, effect of subdivision of labor on worker, nature of business units, the corporation charter, corporation managements, advantages and social aspects of corporations, trusts and monoplies, methods of regulation and control.

Socialism, distributive justice, varieties of socialism, communism, Bol - shevism, socialism and extension of existing institutions, strength and weakness of socialism, social reform, socialist movement, anarchism, ethical and social aspects of the living wage.

Transfers of goods: value, money, credit and banking, international trade, trade balances and exchange.

Distribution:—rent, wages and the labor problem, industrial efficiency, piece wage, profit sharing, democrative organization of industrial management, scientific management, time study, workmen's compensation, insurance, social engineering, welfare work, industrial relations, employment management, housing, trade unionism, vocational education, interest, profits.

Scientific Management.

Industrial Organization.

Public and corporation finance:—revenue, taxes, tariffs and drawbacks, corporation accounting, analysis of financial reports.

Text—*Clay*—Economics for the General Reader.
—*Taylor*—Principles of Scientific Management.
—*Kimball*—Principles of Industrial Organization.

216-217—Electrical Engineering Practice . (See p. 39)

254-255—Electrical Laboratory. (See p. 43)

300A—Steam Engineering Practice. (See p. 46)

350-351—Mechanical Engineering Laboratory. (See p. 48)

409—Engineering Geology. (See p. 58)

429—Metallurgy of Iron and Steel. (See p. 57)

DEPARTMENT OF ELECTRICAL ENGINEERING.

As announced elsewhere, the first two years of this course are given at the affiliated colleges, and students are expected to come to the Nova Scotia Technical College thoroughly grounded in those elementary subjects which are common to all branches of engineering, and fully prepared to proceed with the more specialized work of the third and fourth years.

While the student taking this course has already specialized to the extent of having chosen the particular branch of engineering to which his efforts are in future to be applied, yet the course in Electrical Engineering, as given here is in no sense of the term a specialized course, and no effort is made to give the student special training in any particular branch of Electrical Engineering. Rather it is the intention in this course to give a broad and thorough training in the fundamental theory that underlies all branches of Electrical Engineering. Further specialization is left for the student to follow up, where necessary, after the completion of his regular college course, either in connection with his work or in post graduate courses.

All Electrical Engineering work is necessarily closely associated with many branches of Mechanical Engineering and to a lesser extent with some of the branches of all other kinds of engineering, as Civil in Hydro-Electric Developments, Mining in many refining processes and Chemical in Electro-chemical work. For this reason some of the subjects given are common to other courses, more particularly to those given in Mechanical Engineering.

While it is true that before the student can hope to become a qualified engineer, he must in addition to his college course spend considerable time working, in a more or less humble capacity, to gain practical experience, and that this practical experience cannot be obtained in any laboratory course

at college, yet it does not follow that such a laboratory course is not necessary. On account of the somewhat obscure and invisible nature of the phenomena studied in connection with all electrical subjects, it is impossible for the mind to gain any true conception of the theory unless its study is accompanied by a carefully planned laboratory course, carried out in conjunction with the lectures. It is for this reason that complete and necessarily expensive electrical laboratories form an essential part of the equipment necessary to enable a thorough course in Electrical Engineering to be given. For description of laboratories see pages to .

Text books prescribed on all courses are carefully considered, and in many cases changed from time to time, so as to keep them strictly up-to-date and in line with the best engineering practice known. Care is taken not to load the student up with a lot of books that may prove to be of relatively small value and add unnecessarily to his expenses. All books that are used as references, are in the libraries of the various departments and are available to the students upon request. A great number of useful and interesting books are kept in the Nova Scotia Science Library, which is located in the main building of the N. S. Technical College. These books are also available to the student upon request.

201-202—Electrical Machinery.

Third Year, Electrical Engineering, First and Second Semesters, Three Hours per Week.

This is a course of three lectures per week and is designed to give the student a thorough knowledge of the principles underlying the study of Electrical Engineering and to lay a foundation for the more advanced and detailed work of the fourth year. Broadly speaking the subject is divided into two main divisions, viz., direct and alternating current. A thorough study is first made of direct currents, which includes the following sub-divisions; units, magnetism and electro-magnets, the flow of currents in direct current circuits, work and power, direct current generators, direct current motors, commercial types of machines, meters, storage-batteries and the transmission of direct currents. Following this, alternating currents are taken up and the flow of electric currents in alternating current circuits is carefully studied in some detail. This involves the study of electro magnetic induction and reactance, electro-static capacity and capacity reactance, a study of the mathematics of the sine wave and the analyses of waves other than sine waves. Following this the study of alternating currentt generators and motors is briefly taken up. Laboratory experiments are carried out through-

out the year and are carefully planned so as to work in conjunction with the lectures, and the student is always enabled to verify in the laboratory facts which he has been taught in the lectures.

Text—*Gray*—"Principles and Practice of Electrical Engineering".

Reference: "Standard Handbook for Electrical Engineers".

216-217—Electrical Engineering Practice.

Third Year, Mechanical and Civil Engineering and Fourth Year Mining Engineering, First and Second Semesters, Two Hours per Week.

This course is designed for men who desire to obtain a broad idea of the principles and practice of electrical engineering and who have only a limited amount of time to spend on the subject. For such men it is necessary to emphasize the fundamental principles, and to develop the subject by elaborating on these principles rather than by the solution of mathematical equations, because only in this way can the student be given such a grip of the subject in the short time available, that he is able thereafter to make intelligent use of the data contained in the electrical handbooks, or to take up with advantage a further study of the special treatises on the subject. The course covers much the same ground as that outlined for course 201-202, and differs from it chiefly in that since less time is available, only the salient points are dwelt upon, and less study of detail is possible. Every attempt is made to cover the whole ground in a general way and to familiarize the student with commercial electrical machinery. This course is also accompanied by a laboratory course which is carefully planned to supplement the lectures.

Text—*Gray*—"Principles and Practice of Electrical Engineering".

203-204—Alternating Currents and Machinery.

Fourth Year, Electrical Engineering, First and Second Semesters, Three Hours per Week.

This course is a continuation and to some extent an amplification of courses 201 and 202. In it much of the ground already covered in courses 201 and 202 is reviewed and many details which were previously neglected are carefully considered. The principles of the design of both direct and alternating current machinery are considered and many examples and prob-

lems are worked to emphasize particular points. However, the greater part of the time is devoted to the study of Alternating currents, and much that was barely touched upon in previous courses is taken up in detail. The theory of alternating current circuits and their representation by vector diagrams and vector equations is fully developed. Complex alternating current phenomena, transients and impulses are studied in considerable detail.

Text—*Christie*—"Electrical Engineering".

References: "Standard Handbook for Electrical Engineers".
"American Handbook for Electrical Engineers".
"Alternating Current Motors".—*McAllister*.

209—Electrical Power Plant Engineering.

Fourth Year, Electrical and Mechanical Engineering, Second Semester, Three Hours per Week.

This course deals with the construction, design and operation of electro power plants and the economical selection and arrangement of machinery. A study is first made of all the auxiliary electrical apparatus required in a modern power plant which includes such things as lightning arresters, voltage regulators, meters, relays and protective apparatus, current limiting reactances, and high and low tension switching apparatus, etc. The selection and arrangement of this apparatus in the power house is then considered, always having in mind the class of power house under consideration and the work which the apparatus is likely to be called upon to do. Consideration is given to the design, cost and economics of both Hydro-electric and Steam-electric power plants, and the economics of Steam versus Hydro-electric development is taken up.

Text—*Weingreen*—"Electric Power Plant Engineering".

References *Gear and Williams*—"Electric Central Station Distribution".
Lyndon—"Hydro Electric Power" Vol. II.

211-A—Electric Railways.

Fourth Year, Electrical Engineering, Second Semester, First Eight Weeks, Two Hours per Week.

It is the endeavor in this course to familiarize the student with the

problems encountered by the Electrical Engineer in Electric Railway work, and to consider the various possible solutions for these problems under different conditions. A study is made of urban, inter-urban, and main line electrification; choice of systems; calculation of motor rating and car equipment; methods of control; braking and regeneration; storage batteries and boosters and general considerations.

Text—*Sheldon and Hausman*—"Electric Traction and Transmission Engineering".

References —{"Standard Handbook for Electrical Engineers".
"American Electric Railway Practice"—*Herrick & Boynton.*

211-B—Electric Transmission.

Fourth Year, Electrical Engineering, Second Semester, Last Seven Weeks, Two Hours per Week.

This course deals with the design and construction of Transmission and Distribution lines. A study is made of the methods of calculating the electrical characteristics of long and short, high and low voltage transmission lines as well as methods of calculating sags and stresses in transmission lines. The various types of supporting structures and their suitability for various conditions are considered. Attention is paid throughout to the economics involved and the endeavor is to impress upon the student that the real problem arising in transmission design is to produce a line, which, when all things are taken into consideration, will do the work with the lowest total annual cost.

Text—*Still*—"Electric Power Transmission".

References:—*Lindguist*—"Transmission Line Construction".

214—Electrical Illumination and Photometry.

Fourth Year, Electrical Engineering, First Semester, One Hour per Week.

It is recognized that is is important that the Electrical Engineer of today should have something more than a superficial knowledge of the principles of illumination and this course is designed to give the student a knowledge of the various methods of illumination, both interior and exterior; to familiar-

ize him with photometric units: and to teach the principles governing the design of well planned lighting systems.

Text—*Wickenden*—"Illumination and Photometry".

References:—"Electric Lighting"—*Crocker*.
"High Efficiency Electrical Illuminants and Illumination"—*Hutchinson*.

212-213—Electrical Machine Design.

Fourth Year, Electrical Engineering, First Semester, One Hour Lecture, Three Hours Laboratory per week, Second Semester Six Hours per Week.

A study of Electrical Machine Design is of utmost importance to all Electrical Engineering students, because only by such a study can a knowledge of the limitations of machines be acquired. No attempt is made in this course to teach the student all the details and short cuts or empirical formulae used in commercial machine design, but rather to build up the design for the given rating by the use of a few fundamental formulae and design constants, the meaning and limits of which are discussed thoroughly. The machines studied are those that have become more or less standard, namely, direct-current generators and motors, alternating current generators, synchronous motors, polyphase induction motors and transformers; other apparatus seldom offers an electrical problem that is not considered under one of the above headings.

Text—*Gray*—"Electrical Machine Design".

Reference:—"Dynamo—Electric Machinery"—*Hobart & Ellis*.

215—Storage Battery Engineering.

Fourth Year, Electrical Engineering, First Semester, Two Hours per Week.

In this course a detailed study is made of the Lead-lead storage battery including the details of construction, principle of operation, care and treatment, diseases and their remedies, etc. A study is then made of its field of application and all varieties of ways in which it may be used in combination with other machinery. A study of auxiliary apparatus used in connection with storage battery installation is also taken up.

Text—*Lyndon*—"Storage Battery Engineering".

250-251—Electrical Engineering Laboratory.

Third Year, Electrical Engineering, First and Second Semesters, One Three Hour Period per Week.

This course consists of a series of experiments to accompany the lectures given in courses 201 and 202. Its purpose is to illustrate the fundamental principles and to give the student practice in operating and testing electrical machinery. Most of the work is in connection with direct current machinery and tests as to efficiency, voltage regulation and characteristics are run on all types of direct current generators and similar tests are performed on direct current motors. Various types of meters are studied and calibrated. A study is made of the Potentiometer and Wheatstone Bridge. Studies are also made of the efficiency and characteristics of various types of illuminants as arc lamps (a. c. and d. c.) and incandescent lamps, and tests are run on the storage battery.

Text—*Karapetoff*—"Laboratory Manual".

254-255—Electrical Laboratory.

Third Year, Mechanical Engineering and Civil Engineering and Fourth Year Mining Engineering, First and Second Semesters, One Three-Hour Period per Week.

This course is designed to accompany lectures given in courses 216 and 217 and it is similar to courses 250-251 except that the study of direct current machinery is not carried out in the same detail, but instead the students are given experiments which familiarize them with the methods of operating and general characteristics of alternating as well as direct current machinery. In this way they cover more ground and gain a broad knowledge of all types of electrical machines in general use.

Text—*Karapetoff*—"Laboratory Manual".

252-253—Electrical Engineering Laboratory.

Fourth Year, Electrical Engineering, First and Second Semesters, Two Three-hour Periods per Week.

This course is an extension of courses 250-251 and is conducted in conjunction with lectures given in courses 203-204. During this year the students

perform tests upon all types of alternating machines, including the following: alternating current generators, synchronous motors, induction motors, single phase alternating current motors, including repulsion and commutating types, power transformers and instrument transformers. Rotary convertors are also studied and some extension of the work on direct current machinery is also carried out. A study is made of alternating current meters and methods of metering, alternating, single and polyphase currents, alternating current waves and the effect of harmonics are also studied on the oscillograph. Toward the end of the year, the student is given the opportunity of carrying out any original research work which may appeal to him or of performing any experiments not in the regular routine which he desires in order to clear up points until then, either obscure or perplexing to him. Throughout the whole year any points which arise from the regular work, either by accident or design, and are perplexing to the student, are followed up by him until the point in question has been thoroughly cleared up. It is hoped in this way to teach self-reliance, so that the student will later in practical work feel confident of his ability to attack and solve practical problems as they arise.

Text—*Karapetoff*—"Experimental Electrical Engineering".

Reference:"Practical Alternating Currents"—*Smith.*

101—Mechanics of Engineering I, (See p. 24.)

102—Mechanics of Engineering II, (See p. 24.)

103—Materials Testing II, (See p. 25.)

106—Structures I-A, (See p. 25.)

111—Theoretical Hydraulics, (See p. 26.)

112—Hydraulic Laboratory, (See p. .26)

153—Hydraulic Engineering, (See p. 31.)

300A—Steam Engineering Practice, (See p. 46.)

329-330—Machine Design Theory, (See p. 49.)

329B-330B—Machine Design Theory, (See p. 51.)

331-332—Machine Design Drawing, (See p. 50.)

340-341-342-343—Machine Shop Practice, (See p. .)

350-351—Mechanical Engineering Laboratory, (See p. 48.)

429—Metallurgy of Iron and Steel, (See p. 57.)

500-501-502-503—Military Training, (See p. 33.)

600—Technical Writing, (See p. 35.)

601—Engineering Law. (See p. 35.)

602-603—Social and Industrial Economics (See p. 35.)

303—Steam Power Plants, (See p. 47.)

DEPARTMENT OF MECHANICAL ENGINEERING.

The purpose of the course in Mechanical Engineering is to impart a thorough knowledge of the basic principles of the design, construction, manufacture, and operation of machinery as used in manufacturing industries, power plants, and power transmission, as well as a general idea of the problems to be encountered in the executive and business management of the industries common to all modern civilization. Students who take this course should not only have a thorough elementary training in mathematics, physics, and shopwork, but should have in addition a natural aptitude for machinery, engines, power and hand tools; and no dislike for long hours, hard physical and mental work, and the greasy clothes of a working man.

Any man who can enter this course, after several years' actual experience in machine-shop or power-plant will be the better fitted for it, but for those who have been unable to receive this shop training there is a very modern machine-shop equipment in which the mechanical engineering students will have special training in both their third and fourth years, thus making these men more fitted for their work on their graduation. The demands for such trained men are more than the colleges can supply.

All mechanical engineers require a good general knowledge of applied electricity, and all electrical engineers require thorough training in mechanical principles. Therefore the two courses are similar throughout the third year. In the fourth year the student drops the more advanced electrical work and goes deeper into the study of the design and performance of machinery, steam and gas engines, and turbines. The mechanical laboratories are designed and equipped to give the student the

necessary practice in the handling and testing of machinery in general, and of motive power units particularly. The equipment is complete and modern, and well adapted to illustrate the principles of the course as given in the class-room.

It is not intended to make an expert draughtsman out of every student taking this course; nevertheless, a great deal of work must be done on the drawing-board as it is today absolutely essential that all work shall be completely planned before undertaking any construction. Hence the course includes not only sketching and drawing of machines and their details, but a great deal of graphical and diagrammatic work, rational and empirical designs, and applied kinematics. Those men who enter with a defective knowledge of kinematics will be given a thorough review of the subject, as it is most essential to all engineering work, involving valve-gears, cams, linkages, governors, etc.

300A—Steam Engineering Practice.

Third Year, Civil, Electrical and Mining Engineering, First Semester, Two Hours per Week.

This course deals in an elementary way with the parts of condensing and non-condensing steam plants in regard to their construction, function and operation, under the headings of fuel, combustion, furnaces, boilers, steam production, the steam engine, the steam indicator, engine economy, steam turbines, condensers and auxiliaries.

References:—
- *Ennis*: "Applied Thermodynamics for Engineers".
- *Gebhardt*: "Steam Power Plant Engineering".
- *Benjamin*: "Heat and Steam".
- *French*: "The Steam Turbine".
- *Hutton*: "Steam Engines".
- *Moyer*: "Steam Turbines".
- *Peabody*: "Thermodynamics of Steam Engineering".
- *Shealey*: "Steam Engines and Boilers".

300B-301B—Thermodynamics and Steam Engineering.

Third Year, Mechanical Engineering, First and Second Semesters, Three Hours per Week.

This course is the ground work for all heat engines,—the steam engine,

gas engine and oil engine—also compressors, and correlates with "Steam Engineering Practice" the first term. It starts with the physical equations of a gas which are developed into expressions of the work and efficiency, produced by isometric, isothermal, isodynamic, adiabatic and polytropic changes of state. The laws derived are applied to the air compressor and internal combustion engines to show what is necessary for most efficient expansions or compressions in any case, and also such practical data as the cooling water requirements to obtain these types of expansion or compression. Finally it is applied to the steam engine, after which the steam plant is studied also from a descriptive standpoint, by taking up the construction, function and operation in a general way of the separate units.

303—Steam Power Plants.

Fourth Year, Mechanical and Electrical Engineering, First Semester, Three Hours per Week.

A general study of choice of types in power station equipment; the economics of efficiency vs. cost; fixed and operating charges; local conditions relative to each case which govern in choice of machinery; the cost of power; the laying out of power plants under assumed working conditions; design, preparation of bill of material, estimating the first cost; the influence of the cost of raw material, fuel, water, labor, and load factor, on the design; preparation of contract and specifications.

Text—*Meyer*—"Steam Power Plants".

References: *Gebhardt*:—"Steam Power Plant Engineering."
Morrison:—"Oil Engines."
Carpenter and Diedrichs:—"Gas Engine."
Morris:—"Steam Power Plant Piping."

305—Steam Turbines.

Fourth Year, Second Semester, Mechanical Engineering, Two Hours per Week.

A study of the types of turbines and the theory of their performance, the flow of steam and its action on the curved surface of the buckets, efficiency of turbines and their utility in general as compared with other forms of steam engine.

Text—*Meyer*:—"Steam Turbines."

306—Gas Engines.

Fourth Year, Mechanical Engineering, Second Semester, Three Hours per Week.

Gas engine types and points to be considered in making selections, small gas and gasoline engines, stationary and marine larger producer gas engines, their design and operation, including methods of starting and igniting and sources of trouble; gas producers, their design, operation and efficiency.

References: *Morrison*:—"Oil Engines."
Lucke:—"Gas Engine Design."
Carpenter and Diedrichs:—"Gas Engines."
Jones:—"Gas Engine."
Robinson:—"Gas and Oil Engines."

307—Mechanical Engineering Abstracts.

Fourth Year, Mechanical Engineering, First Semester, One Hour per Week.

This is a course dealing with current engineering problems. Topics will be assigned and reports required, based on discussions in current engineering magazines, which will be on file in the library of the college.

340-341-342-343—Machine Shop Practise.

Third and Fourth Year, Electrical and Mechanical Engineering, First and Second Semesters, Four Hours per Week.

This course is intended to give the engineering student a practical knowledge of the construction and operation of modern machine tools, together with the laying out, manufacture, and assembly of machine parts.

Repair of equipment, construction of typical commercial jobs and tool making conducted by standard machine shop methods, will also be included in this course.

350-351—Mechanical Engineering Laboratory.

Third Year, Mechanical, Electrical, Mining and Civil Engineering, First and Second Semesters, One Hour Lecture and Three Hours Laboratory per Week.

A course of study, testing and calibration of gauges, indicators, brakes and other measuring instruments; determination of the properties of lubricants; determination of the properties of saturated steam; investigation of the assembly and operation of simple steam engines; investigation and study of several types of valves and valve motions together with diagrams and valve setting; mechanical efficiency of steam engines; determination of moisture

contents in steam by various calorimeters; complete boiler trials; determination of the duty of pumps; determination of the calorific values of different gases; visits to neighboring plants; complete trials of simple and compound engines, condensing and non-condensing, to determine their steam consumption, efficiency and other items necessary to the engineer.

This course runs concurrently with courses Nos. 300A, 300B, 301B, and although it may vary slightly from year to year, the above is a fair representation of the work done by the students.

352-353—Mechanical Engineering Laboratory.

Fourth Year, Mechanical Engineering, First and Second Semesters, Three Hour per Week.

A continuation of courses No.350-351, and deals with the more difficult problems of efficiency tests, power plant and commercial tests. Visits will be made to local plants and in some cases arrangements may be made to conduct tests under the direction of the college officials.

References: *Carpenter*:—"Experimental Engineering."
Flather:—"Dynamometers and Measurements of Power."

322—Heating, Ventilation and Refrigeration.

Fourth Year, Mechanical Engineering, First Semester, Three Hours per Week.

This course is planned to take up in a practical way the fundamental principles of heating, ventilation and refregeration as applied to modern construction. In heating and ventilation, the layout for a large building which proved successful is studied and little time will be given to ultra-theoretical work in this subject. In refrigeration, the different types of plants are studied according to the refrigerant employed, and the commercial method of capacity rating.

References: *Carpenter*:—"Heating and Ventilating."
Baldwin:—"Heating and Ventilating."
Sturtevant:—"Heating and Ventilating."

329-330—Machine Design Theory.

Third Year, Mechanical and Electrical Engineering, First Semester, Three Hours per Week, Second Semester, Two Hours per Week.

This course of lectures is planned to acquaint the student with the properties and principles of the strength of materials as applied to the design of the parts of machines; fastenings used in machine construction; bolts, screws, keys, cotters, rivets and riveted joints, journals and bearings; shafts and couplings, and the manufacture, design and construction of gear trains. Included in this course are numerous problems on the above mentioned headings to made the student efficient in the application of theory to the quick and correct design of machines.

References: *Spooner*:—"Machine Design".
Unwin:—"Machine Design".
Lentwiler:—"Machine Design".

331-332—Machine Design and Drawing.

Third Year, First and Second Semesters, Mechanical Engineering, Six Hours per Week, Electrical Engineering, Three Hours per Week.

This course is conducted in the Draughting Room and consists of exercises in making sketches of machine parts, and in preparing working drawings, tracings and blue prints from them. It also includes the design of simple machines, and parts of more complex machines, piping layouts and the design of gears, racks and pinions, following parallel to courses Nos. 329 330. The Electrical Engineering students cover the same type of work but less extended.

333—Machine Design.

Fourth Year, Mechanical Engineering, First Semester, Three Hours per Week.

The main object of this course is a broader application of the principles involved in courses No.331-332. Each student makes a number of complete designs, including machines such as presses, punches and riveters, as well as flywheels, shafting and gears. Special features of machines such as bearings, connecting rods, and crank shafts are made the subject of careful analysis. Calculations are worked out and detailed drawings are prepared.

334—Machine Design.

Fourth Year, Mechanical Engineering, Second Semester, Three Hours per Week.

This course is laid out to suit the requirements of the student. The design of machines of considerable magnitude is taken up. Such problems

as the design of pumps, air compressors, and travelling cranes form the basis of instruction. When desirable the student may choose the design of some special apparatus to be used in an original investigation. This is purely a draughting room course and is much more advanced than previous design courses and requires concentrated effort.

329B-330B—Machine Design Theory.

Fourth Year, Mechanical and Electrical Engineering, First Semester, Two Hours per Week, Second Semester, Three Hours per Week.

A continuation of course No. 330, dealing with the design of tanks, transmission machinery including belts, ropes, chains, friction and toothed gearing; the design of engine details including cylinders, piston rods, connecting rods, shafts, flywheels, governing and valve mechanisms, frames, and the balancing of engines. Problems and designs to be worked outside of college hours and the investigation and criticism of such new designs as may come out during the student's year, is a special feature of this course.

References: *Spooner*:—"Machine Design".
Reid:—"Machine Design".
Unwin:—"Machine Design".
Lentwiler:—"Machine Design".
Anthony:—"Essentials of Gearing".

344—Steam Engine Design.

Fourth Year, Second Semester, Mechanical Engineering, Three Hours per Week.

This course runs concurrently with 329B-330B, and is carried out in the Draughting Room, where a complete design of a reciprocating engine is made. Application of the scientific principles of heat engineering and mechanics, to determine the proper steam distribution is carefully considered together with the size and strength of the required machine parts.

101—Mechanics of Engineering I, (See p. 24.)

102—Mechanics of Engineering II, (See p. 24.)

103—Materials Testing II, (See p..) 25

106—Structures IA, (See p. 25.)

111—Theoretical Hydraulics, (See p.26.)

112—Hydraulic Laboratory, (See p. 26.)

153—Hydraulic Engineering, (See p. 31.)

216-217—Electrical Engineering Practice, (See p. 39.)

254-255—Electrical Laboratory, (See p. 43.)

209—Electrical Power Plant Engineering, (See p. 40.)

429—Metallurgy of Iron and Steel, (See p. 57.)

500-501-502-503—Military Training, (See p. 33.)

600—Technical Writing, (See p. 35.)

601—Engineering Law, (See p. 35.)

602-603—Social and Industrial Economics, (See p. 35.)

DEPARTMENT OF MINING ENGINEERING.

403—Qualitative Analysis.

Third Year, Mining Engineering, First Semester, One Hour per Week Lecture, Six Hours per week, Laboratory.

The lectures treat of the theory of qualitative analysis and the chemistry of the reactions involved in the laboratory work. The laboratory work in cludes the practice of manipulation and the laboratory study of the bases and acids, their reactions and detection.

Text—*Bevins*:—"Qualitative Chemical Analysis."

Reference:—*Smith*:—"General Chemistry for Colleges."

404—Quantitative Analysis.

Third Year, Mining Engineering, Second Semester, Nine Hours per Week Laboratory.

The aim of this course is to acquaint the student with the theory and practice of representative methods of gravimetric and volumetric quantative analysis. A high standard of accuracy is required. Reports must be written up to date and submitted to the instructor at the completion of each separate analysis. Each student is required to make a deposit to cover breakage. The following analyses are included in the course and are supplemented with extra work according to the rapidity with which each individual works: determination of water, barium and chlorine in barium chloride; magnesia, sulphuric acid and water in potash alum; analysis of limestone; preparing normal solutions; analysis of acids and alkalis; temporary and permanent hardness of water; iron ores by the bichromate and permanganate methods; chlorine in bleaching powders; oxidizing power of pyrolusite; carbon, silicon, sulphur, manganese and phosphorus in steel or pig iron; copper, lead, and zinc in ores; proximate analysis, sulphur and calorific power of coal.

Texts { *Allan*:—"Quantitative Chemical Analysis." *Aungst*:—"Technical Chemical Analysis." *Lord and Demorest*:—"Metallurgical Analysis."

404A—Quantitative Analysis.

Third Year, Mining Engineering, First Semester, One Hour per Week.

This is a course of lectures to accompany course No. 404. It covers the work done in the laboratory and includes discussions of quantitative separations from a theoretical standpoint, as well as chemical calculations and a short course in Elementary Physical Chemistry.

Text—*Talbot and Blanchard*:—"Electrolytic Dissociation Theory."

406—Mineralogy.

Third Year, Mining Engineering, First Semester, Two Hours Lectures and Four Hours Laboratory per Week.

This course includes descriptive and determinative mineralogy and a

brief introduction to crystallography. The time will be largely given to laboratory work in order to train the student to determine minerals accurately and rapidly by their physical and chemical properties, to make him thoroughly acquainted with the appearance, properties, uses and association of the more important ore making minerals. This is followed by determinative mineralogy proper.

Texts { *Moses and Parsons*:—"Crystallography, Mineralogy, and Blow-Pipe Analysis." / *Butler*:—"Hand-book of Minerals."

References: { *Brush and Penfield*:—"Manual of Determinative Mineralogy and Blow-pipe Analysis." / *Dana*:—"Textbook of Mineralogy."

425—Principles of Metallurgy.

Third Year, Mining Engineering, First Semester, Two Hours per Week.

This course serves as an introduction to the metallurgy of non-ferrous metals and also to the course on the metallurgy of iron and steel. The subjects treated include a study of metals and alloys, their physical properties and thermal analysis, fuels, slags, gas producers, furnaces, pyrometry refractories and metallurgical products.

Text—*Fulton*:—"Principles of Metallurgy."

References: { *Hofman*:—"General Metallurgy." / *Chauveult*:—"Chemical Arithmetic."

420—Assaying.

Third Year, Mining Engineering, Second Semester, One Hour Lecture and Four Hours Laboratory per Week.

The purpose of this course is to acquaint the student with the theory and practice of fire assaying as carried out to-day. The training prepares the student for the course in metallurgical laboratory, where he is required to trace the ore values through the mill runs and metallurgical tests that make up the course. It also prepares him to quickly become an expert assayer after he leaves college, if he starts his engineering practice in such a position. Lectures are given from time to time covering the following points:

assay furnaces, tools, reagents, sampling, weighing, reduction and oxidation reactions, slag formation; the various methods of crucible fusion, scorification, cupellation, parting and special methods for special ores and metallurgical products. Reports will be required weekly, and must be kept up to date, otherwise full value for the work cannot be obtained. The following assays are required:—Reducing power silver ores by scorification and crucible assay, gold ores by pot and muffle furnace fusion, lead ores by crucible fusion, ores with metallics, special ores and metallurgical products. A deposit of $5.00 will be required to cover cost of crucibles etc. used.

Text—*Bugbee*:—"Notes on Assaying."

Reference: *Lodge*:—"Notes on Assaying."

410—Metallurgical Laboratory.

Fourth Year, Mining Engineering, Second Semester, Three Hours Laboratory, per Week.

This course in laboratory work accompanies the courses in Principles of Metallurgy, Metallurgy of Iron and Steel and Electro-metallurgy.

The following include some of the metallurgical tests performed:—

Pyrometry and calibration of pyrometers, microscopic metallography and thermal treatment of steel.

427—Metallurgy of Iron and Steel.

Third Year, Mining Engineering, Second Semester, Two Hours per Week.

In this course the metallurgy of iron and steel as carried out to-day is dealt with thoroughly. Much stress is laid upon metallurgical and thermal chemistry as applied to the iron and steel industry.

Pig Iron:—Ores, fuels and fluxes, iron blast furnace and accessories, smelting practice, chemistry of smelting process, calculating blast furnace charge, comparison of processes of purification of pig iron.

Wrought Iron and Crucible Steel:—Different processes of making wrought iron, elimination of impurities. Process and plant for making crucible steel, chemistry of processes.

Acid and Basic Bessemer Steel:—Plant and modern practice of acid

and basic processes, chemistry and thermal efficiency of converters, comparison of two processes.

Acid and Basic Open-Hearth Steel:—Open-hearth furnaces and accessories, acid and basic open-hearth practice. Special open-hearth processes, duplex process, chemistry and thermal efficiency of processes.

Mechanical Treatment of Steel:—Forging, rolling, stamping, drawing, etc. Rolling Mill practice, heating furnaces.

Iron and Steel Foundry:—Making of moulds, design of patterns, cupola furnaces, steel casting practice, malleable castings.

Constitution of Iron and Steel:—Solution theory as applied to metals and their alloys, freezing curves, Roozeboom diagram, micro-constitutents of iron and steel, metallography of iron and steel, physical properties, effect of impurities on cast iron and steel.

Heat Treatment of Steel:—Annealing, hardening and tempering of steel, improper heat treatment, constituents of hardened and tempered steel.

Special Alloy Steel.

Corrosion of Iron and Steel.

Text—*Stoughton*:—"Metallurgy of Iron and Steel."

References: { *Howe*:—"Iron, Steel and other Alloys." / *Bullen*:—"Steel, and its Heat Treatment."

428—Electrometallurgy.

Third Year, Mining Engineering, Second Semester, One Hour per Week.

The course serves as an introduction to the study of electrometallurgy.

It includes the theory and application of the electric current to:—extraction of metals from ores by electrolysis and smelting, the refining of metals and the recovery of associated constituents, the production of steel and refractory alloys in the electric furnace.

The metals considered are:—copper, lead, iron, nickel, antimony, silver, gold, aluminum and zinc and the alloys of iron with silicon, chromium, tungsten, vanadium, etc.

429—Metallurgy of Iron and Steel.

Fourth Year, Civil Engineering, Mechanical Engineering and Third Year Electrical Engineering, First Semester, Two Hours per Week.

This course covers the same subjects as are taken in course No. 427 but in an abridged form, the idea being to deal principally with the physical and chemical properties of iron and steel rather than with the metallurgical processes of manufacture.

The following are taken in detail,—The properties of steel, cast iron, and wrought iron as influenced by composition and mechanical treatment together with a brief account of the chief processes of manufacture.

405—Structural Geology.

Third Year, Mining Engineering, Second Semester, Fifteen Weeks, Three Hours per Week.

This course is taken in two lectures and one laboratory hour per week. A brief course is given in the microscopic study of rocks and rock minerals, but more stress is laid on the study of rocks by megascopic means. The laboratory hour is given to this work, for which a large collection of rock samples is provided. The lecture work covers the classification of rocks: rock structures such as joints, folds, fissures and faults; and the action of underground and surface waters on rocks. Particular attention is paid to the economic phases of these subjects. The lecture course closes with a brief description of the methods of making geological surveys of mining properties.

Text—*Pirsson*—Rocks and Rock Minerals.

References { *Farrel and Moses*—Practical Field Geology.
Hayes—Handbook for Field Geologists.
Spurr—Geology Applied to Mining.
Leith—Structural Geology.

407—Economic Geology.

Fourth Year, Mining Engineering, First Semester, Two Hours per Week.

This course takes up a discussion of the theory of the origin of ore deposits, particularly those of the metallic minerals. Attention is drawn to the aid

which an understanding of these principles may give in the prospecting, exploration, and development of mines. Detailed descriptions of some of the principal mineral deposits of Canada are given.

Text—*Emmons*—Principles of Economic Geology.

References { *Lindgren*—Mineral Deposits. *Kemp*—Ore Deposits of the United States and Canada. *Ries*—Economic Geology. Reports of the Geological Surveys of Canada.

408—Economic Geology.

Fourth Year, Mining Engineering, Second Semester, Two Hours per Week.

This course is a continuation of that given in the first semester. It will deal with the non-metallic minerals, building stones and road materials, clay, lime, and cements, salt, gypsum, fertilizers and abrasives. Particular attention will be given to the geology of coal, oil, and gas and the course will include detailed descriptions of the coal fields of Nova Scotia.

Text and References are the same as for No. 407.

409—Engineering Geology.

Third Year, Civil Engineering, Second Semester, Two Hours per Week.

This is a simple course in general geology adapted to the needs of the civil engineering students. It includes the determination of the commonest rocks and minerals.

Text—*Ries*—Engineering Geology.

453—Ore Dressing.

Fourth Year, Mining Engineering, First Semester, Fifteen Weeks, Five Hours per Week.

This course is given in two lecture hours and one laboratory period of three hours per week. It aims to give the student a thorough knowledge of the principles and modern practice of ore dressing. The machines studied are: crushers, breakers, rolls, stamps, ball and pebble mills, roller mills,

screens, classifiers, jigs, concentrating tables, slime tables, flotation machines, magnetic and electrostatic machines. Tests will be made in small lots of ores in a laboratory equipped with laboratory size machines where each student will be required to control the operation of the machine.

Text and References
- *Richards*—"Ore Dressing."
- *Wiard*—"Theory and Practice of Ore Dressing."
- *Megraw*—"The Floatation Process."
- *Hoover*—"Concentrating Ores by Flotation.'

455—Ore Dressing.

Fourth Year, Mining Engineering, Second Semester, Fifteen Weeks, Eight Hours per Week.

This course is given in two lecture hours and a laboratory period of six hours per week, and is a continuation of that given in the first semester. It will take up a study of the combinations of the different machines, mill processes and management. This will be illustrated by descriptions of modern milling plants and processes. Attention will be given to the testing of an ore for a process and time in the laboratory will be spent on this work. The students will be required to make tests and report on a process for different ores. Some of the preliminary work may be done on the laboratory size testing machines but large mill runs will also be made with the larger machines in the mill in the Murray Mining Laboratory.

Text and References
- *Richards*—"Ore Dressing".
- *Wiard*—"Theory and practice of Ore Dressing".
- *Megraw*—"The Flotation Process".
- *Hoover*—"Concentrating Ores by Flotation".

415—Mine Surveying and Mapping.

Third Year, Mining Engineering, First Semester, Fifteen Weeks, Four Hours per Week.

This course consists of one lecture hour and one drafting room period of three hours per week. It aims to acquaint the student with the special adaptations of surveying instruments and practice to underground mining work.

The lectures describe instruments used, illumination, methods of measur-

ing angles and distances, methods used in inclined deposits, use of auxiliary telescope, plumbing shafts, survey of bore holes, and construction of mine models.

Drafting room practice covers the taking and recording of notes, calculations, plotting from notes, construction of mine maps and sections, and problems of intersection of veins with the surface, with one another, and intersecting faults.

Text—*Durham*—"Mine Surveying."

426—Non-Ferrous Metallurgy.

Fourth Year, Mining Engineering, First Semester, Three Hours per Week.

This course takes up a study of the principles underlying the treatment of gold, silver, copper, lead and zinc ores and the application of these principles in modern metallurgical practice. The course also takes up the marketing of ores and the different products of the smelters.

Gold—This subject takes up a study of stamp milling and amalgamation.

Silver—Most of the time in this subject is given to a study of the cyanide treatment of silver ores with a brief treatment of the roasting of silver ores, pan amalgamation and leaching methods.

Copper—Lectures on this subject cover the roasting of copper ores, blast furnace and reverberatory smelting, slags, production of metallic copper from matte, and furnace and electrolytic refining of copper. Modern leaching methods applied to copper ores will also be studied.

Lead—The work on this subject covers the roasting of lead and silver-lead ores and their treatment in the furnace. The methods of refining and desilverising base bullion are described.

Zinc—The treatment of zinc ores in retorts and by leaching methods is briefly described.

Text—*Gowland*—Non-Ferrous Metallurgy.

References:
- *McFarren*—Textbook of Cyanide Practice.
- *Hofman*—Metallurgy of Copper.
- *Hofman*—Metallurgy of Lead.
- *Ingalls*—Metallurgy and Properties of Zinc.

460—Mill Construction.

Fourth Year, Mining Engineering, First Semester, Two Hours per Week.

This course treats of the construction and equipment of mill, smelter, and mine buildings. It covers a great number of details which the student does not get in his other classes but which the mining engineer frequently needs.

Points to which attention is given are building foundations, cements and mortars, concrete work, masonry, timber framing, headframes, trusses and trestles, laying out building and machinery foundations, erection of buildings and machines and boilers, shafts, belts and pulleys, dams and retaining walls.

Text—Mining Engineers' Handbook.

References: *Hobart*—Millwrighting.
Kent—Mechanical Engineers' Handbook.
Merriman—Americal Civil Engineers' Handbook.
Ketchum—Design of Mill Structures.

461-462—Mine Plant Design.

Fourth Year, Mining Engineering, First Semester, Six Hours per Week; Second Semester, Eight Hours per Week.

In this course the student is required to design some actual small plant, or some portion of a small plant, as would be necessary in the development of a mining or metallurgical enterprise. Working drawings of some such plant or accessory as a stamp mill, steel or wooden headframe, cyanide mill, wet concentration mill, flotation plant, mine buildings, trestles, skip, cage or ore bin are prepared. The drawings must be supplemented by bills of materials, specifications and estimates of cost of erection and operation.

References: *Peele*—"Mining Engineers' Handbook".
Ketchum—"Design of Mill Structures".
Hobart—"Mill-wrighting".

463—Explosives and Compressed Air Machinery.

Third Year, Mining Engineering, First Semester, Fifteen Weeks, Two Hours per Week.

Explosives: Composition of gunpowder and high explosives, such as gun cotton, nitroglycerine, dynamites and blasting gelatine; use and care of explosives, fulminates, safety explosives, detonators and fuses; the theory of blasting and methods of drilling for excavations; the use of electric machines for firing.

Compressed Air Machinery: Development of air compressors and the theory of their operation; wet and dry compressors, straight line and duplex, simple and compound compression; inlet and discharge valves; graphic determination of horse-power and calculation of duty and efficiency; use of air receivers and reheating; air compression by direct action of falling water; a study of the various types of air and electric rock drills; their care and operation; compressed air as applied to coal cutting machinery, locomotives and auxiliary engines for hoisting.

References
- *Young*—"Elements of Mining".
- *Peele*—"Mining Engineering Handbook".
- "Primer on Explosives".
- *Peele*—"Compressed Air Plant for Mines".
- *Weston*—"Rock Drills".

464—Boring, Drifting and Shaft Sinking.

Third Year, Mining Engineering, Second Semester, Fifteen Weeks, Three Hours per Week.

Boring: Hand augers, well augers and Empire drill; the use and operation of the churn drill in the exploration of oil and mineral deposits; diamond drills, shot drills and the surveying of bore holes; cost of installation and operation of the various methods.

Drifting: The driving of tunnels in hard and soft ground; timbering and support of tunnels and drifts; use and preservation of timber in mining; structural steel in mine workings; the drilling of holes and use of explosives in driving tunnels.

Shaft Sinking: Methods of drilling, firing and sinking, different methods

of supporting circular and rectangular shafts; details of shaft timbering and concreting; special methods of sinking in running ground, forepoling, sinking shoe with brick or concrete lining, tubbing, Poetsch freezing process, Kind-Chaudron process, caissons, cementation; cost of sinking shafts under various conditions.

Texts: { *Donaldson*—"Practical Shaft Sinking".
Storms—"Timbering and Mining".

465—Prospecting. Development and Methods of Mining.

Fourth Year, Mining Engineering, First Semester, Fifteen Weeks, Three Hours per Week.

Prospecting: Practical application of geology; properties of minerals and principal constituents of ores; recognition of minerals in the field; lodes and surficial deposits; trenching and trial pits.

Development: Methods used in opening up various types of deposits; use of vertical and inclined shafts; use of drifts, tunnels and slopes; establishment of ore reserve.

Methods of Mining: Methods of breaking ore: overhand stoping, underhand stoping, breast stoping, longwall stoping; methods of handling ore timber and supplies in stopes; mining by the use of props; methods of placing stulls and square sets; shrinkage sloping and filling methods as applied to wide veins and masses; caving methods; surface mining by scrapers; open cut mining by steam shovel; the milling method.

Texts and References:
Richards:"Mining Notes".
Hughes—"Text-book on Coal Mining".
International Text-book Co.—"Coal Mining".
Hoover—"Principles of Mining".
Brinsmeade—"Mining Without Timber".

466—Mine Drainage, Haulage and Ventilation.

Fourth Year, Mining Engineering, Second Semester, Fifteen Weeks, Two Hours per Week.

Drainage: Sources of mine water and prevention of inflow; use of

underground dams and drainage tunnels; classification and location of mine pumps; electrical, steam and compressed air driven pumps; Cornish pumping system; piston and plunger, inside and outside packed, duplex pumps, differential plunger pumps, compound and triple expansion pumps, centrifugal pumps, Frenier pumps, bucket lifts, pulsometers, air lift rotary pumps; valve gears for various types of pumps; pump duties and costs of pumping.

Haulage: General considerations of transport methods; cars, tracks, ropes, animal, steam, air, and electric haulage; comparative costs; wire rope haulage systems; details and comparative cost of endless rope and main and tail rope haulage, back balances, mine tubs and aerial tramways; hoisting winch, windlass and whim; power machinery for hoisting, steam engines for hoisting, first and second and third motion geared engines; use of water wheels, gasoline engines and electric motors for hoisting; cylindrical and conical drums, reels, various forms of hand, steam and automatic brakes; methods and calculation of compensation; calculations for size of hoisting engine and rope; Koepe and Whiting systems; study of ropes, rope crossings, buckets, cages and skips, pulleys, detaching hooks, safety clutches; surface and underground arrangement of hoisting plant; headframe and accessories, hoisting engines, calculation for size of engines, counterbalancing; special methods of winding in coal mines.

Ventilation: Gases met with in mines, coal dust, laws of friction, theory of air currents, mechanical ventilators, details of different types, fan engines, motors and methods of connection, secondary ventilation, useful effect, efficiency, stoppings, doors, brattice, regulators, air-crossings, losses in circulation, theory of splitting problems; testing for various gases, explosive mixtures, natural ventilation by furnace, water blast, steam jets and fan ventilation; various types of fans as Guibal, Schiele, Capell, Nasmythe, Murphy, Waddell and Sirocco; monometric efficiency; production of air currents, equivalent orifice of a passage, summation of orifice in series, graphic method of orifices, mine explosions, mode of procedure to recover miners and mines, rescue breathing apparatus, mine fires, cause and methods of suppression or exclusion.

Lighting: Candles, torches, actylene lamps, naked lamps; modern lamps such as Ashworth, Muessler, Marscuilt, Wolf, Morgan, etc; underground lighting and lighting stations; delicate indicators such as Pieler, Chesmeau, Stokes, Ashworth, Shaw.

Texts and References:

Richards—"Mining Notes".

International Text-book Co.—"Coal Mining".

467—Valuation and Accounting.

Fourth Year, Mining Engineering, Second Semester, Fifteen Weeks, One Hour per Week.

Valuation: Principles underlying mine sampling and valuing; implements used in and general methods of sampling; geological factors in sampling and valuation; churn drilling as applied to sampling; handling and preparation of samples; assaying of samples, estimation of ore and calculation of profits; writing reports; salting of samples and mines; examination of prospects and re-opened old mines; sampling of placer deposits.

Accounting: Capital and suspense accounts, amortization, depreciation; outline of accounts; outline of essential records; general office records of accounts; time-keepers' records; general office records of supplies; warehouse records; monthly statements; records and reports of daily operations; merchantile store operation.

Texts and References:

Wallace—"Simple Mine Accounting".
Rickard—"Sampling and Estimation of Ore in a Mine".
Hoover—"Principles of Mining".
Charlton—"American Mine Accounting".
Finlay—"Cost of Mining".
Herzig—"Mine Sampling and Valuing".

101—Mechanics of Engineering I, (See p. 24.)

102—Mechanics of Engineering II, (See p. 24.)

—Materials Testing II, (See p. 25.)

111—Theoretical Hydraulics, (See p. 26.)

112—Hydraulic Laboratory, (See p. 26.)

123—Summer Surveying Camp, (See p. 28.)

216-217—Electrical Engineering Practice, (See p. 39.)

254-255—Electrical Laboratory, (See p. 43.)

300A—Steam Engineering Practice, (See p. 46.)

350-351—Mechanical Engineering Laboratory, (See p. 48.)

500-501-502-503—Military Training, (See p. 33.)

600—Technical Writing, (See p. 35.)

601—Engineering Law, (See p. 35.)

602-603—Social and Industrial Economics, (See p. 35.)

Summer Surveying. Three Weeks Field Practice. Course No. 123. Page 28

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Mechanics of Eng. I	Mechanics 1	15	5	.....	24	101	Third Year Entrance.
Advanced Surveying I	Civ. Eng. 1	15	1	3	27	119	Third Year Entrance
Railroad Engineering I	Civ. Eng. 2	15	3	.....	27	121	Third Year Entrance.
Highway Engineering	Civ. Eng. 18	15	2	.....	29	131	Third Year Entrance
Materials Testing I	Civ. Eng. 19	15	.....	3	29	132	Concurrent with No. 131
Electrical Eng. Practice	Elec. Eng. 23	15	2	.....	39	216	Third Year Entrance.
Electric Laboratory	Elec. Eng. 25	15	.....	3	43	254	Concurrent with No. 216
Steam Eng. Practise	Mech. Eng. 26	15	2	.....	46	300A	Third Year Entrance
Mech. Eng. Laboratory	Mech. Eng. 29	15	1	3	48	350	Third Year Entrance.
Military Training	Mil. Sci. 1	15	.....	2	33	500	Third Year Entrance

Third Year. Second Semester

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Mechanics of Eng. II	Mechanics 2	15	3	.....	24	102	Course No. 101
Materials Testing II	Mechanics 3	15	.....	3	25	103	Concurrent with No. 102
Structures I	Civ. Eng. 3	15	2	.....	25	105	Course No. 101
Advanced Surveying II	Civ. Eng. 4	15	2	3	27	120	Course No. 119
Railroad Engineering II	Civ. Eng. 5	15	3	.....	28	122	Course No. 121
Electric Eng. Practice	Elec. Eng. 24	15	2	.....	39	217	Course No. 216
Electric Laboratory	Elec. Eng. 26	15	.....	3	43	255	Concurrent with No. 217
Mech. Eng. Laboratory	Mech. Eng. 4	15	1	3	48	351	Course No. 350
Engineering Geology	Geol. 5	15	2	.....	58	409	Third Year Entrance
Technical Writing	English 1	15	1	.....	35	600	Third Year Entrance
Miltary Training	Mil. Sci. 2	15	.....	2	33	501	Course No. 500

Fourth Year — **CIVIL ENGINEERING.** — **First Semester**

Summer Surveying. Three Weeks Field Practice. Course No. 124 Page 28

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Theoretical Hydraulics	Hydraulics 1	15	3	.....	26	111	Courses No. 101, 102
Hydraulic Laboratory	Hydraulics 2	15	.....	3	26	112	Concurrent with No. 111
Masonry & Foundations	Civ. Eng. 20	15	3	.....	29	141	Courses No. 101, 102
Materials Testing III	Civ. Eng. 21	15	.....	3	30	142	Concurrent with No. 141
Structures II	Civ. Eng. 9	15	3	.....	32	174	Course No. 105
Reinforced Concrete	Civ. Eng. 22	15	2	.....	33	178	Courses No. 102, 105
Structural Design I	Civ. Eng. 10	15	.....	9	32	176	Concurrent with No. 174
Metallurgy of Iron & Steel	Metallurgy 7	15	2	.....	57	429	Third Year Entrance
Social & Ind. Economics	Economics 1	15	2	.....	35	602	Third Year Entrance
Military Training	Mil. Sci. 3	15	.....	2	33	502	Course No. 502

Fourth Year — **Second Semester**

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Masonry Design	Civ. Eng. 23	15	.....	3	30	143	Courses No. 141, 178
Water Supply	Civ. Eng. 11	15	3	.....	30	151	Courses No. 111, 112
Hydraulic Engineering	Hydraulics 3	15	3	.....	31	153	Courses No. 111, 112
Hydraulic Design	Civ. Eng. 12	15	.....	3	30	152	Concurrent with No. 153
Sew. & Sewage Disposal	Civ. Eng. 13	15	3	.....	31	162	Courses No. 111, 112
Sewer Design	Civ. Eng. 14	15	.....	3	31	163	Concurrent with No. 162
Structures III	Civ. Eng. 15	15	3	.....	32	175	Course No. 174
Structural Design II	Civ. Eng. 16	15	.....	9	32	177	Concurrent with No. 175
Engineering Law	Contracts	15	1	....	35	601	Third Year Entrance
Soc. & Ind. Economics	Economics 2	15	2	.....	35	603	Course No. 602
Military Training	Mil. Sci. 4	15	.....	2	33	503	Course No. 502

Third Year. ELECTRICAL ENGINEERING. First Semester.

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Electrical Machinery	Elec. Eng. 1	15	3		38	201	Third Year Entrance
Elect. Eng. Laboratory	Elec. Eng. 2	15		3	43	250	Third Year Entrance
Steam Eng. Practice	Mech. Eng. 26	15	2		46	300A	Third Year Entrance
Mech. Eng. Laboratory	Mech. Eng. 29	15	1	3	48	350	Concurrent with 300A
Mechanics of Eng. I	Mechanics 1	15	5		24	101	Third Year Entrance
Metallurgy of Iron & Steel	Metallurgy 7	15	2		57	429	Third Year Entrance
Mach. Design Theory	Mech. Eng. 1	15	3		49	329	Third Year Entrance
Mach. Design & Drawing	" " 2A	15		3	50	331	Concurrent with course 329
Machine Shop Practice	" " 20	15		4	40	340	Third Year Entrance
Military Training	Military Sci. 1	15		2	33	500	Third Year Entrance

Third Year. Second Semester.

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Electrical Machinery	Elect. Eng. 4	15	3		38	202	Course No. 201
Elect. Eng. Laboratory	Elect. Eng. 5	15		3	43	251	Concurrent with course 202
Thermodynamics	Thermo 2A	15	4		46	301B	Course 354
Mech. Eng. Lab	Mech. Eng. 4	15	1	3	48	351	Courses No. 350 & 354
Mechanics of Eng. II	Mechanics 2	15	3		24	102	Course No. 101
Materials Testing II	Mechanics 3	15		3	25	103	Concurrent with Course 102
Structures I-A	Civil Eng. 24	15	2		25	106	Course No. 101
Military Training	Mil. Sci. 2	15		2	33	501	Course No. 500
Technical Writing	English 1	15	1		35	600	Third Year Entrance
Machine Shop Practice	Mech. Eng. 21	15		4	40	341	Course No. 340
Mach. Design Theory	Mech. Eng. 3	15	2		49	330	Course No. 329
Mach. Design & Drawing	Mech. Eng. 5-A	15		3	50	332	Course 331

Fourth Year. **ELECTRICAL ENGINEERING.** **First Semester.**

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Alter. Currents & Mach'y	Elect. Eng. 7	15	3	.....	39	203	Courses No. 202-251
Electrical Mach. Design...	" " 17	15	1	3	42	212	" " 202-330
Storage Battery Eng.....	" " 10	15	2	.....	42	215	Course " 202
Illumination & Photometry	" " 22	15	1	.....	41	214	" " 202
Elect. Eng. Laboratory....	" " 8	15	.....	6	43	252	" " 251
Mach. Design Theory.....	Mech. Eng. 7...	15	2	.....	51	329B	Courses " 330-332
Steam Power Plants.....	Mech. Eng. 8...	15	3	.....	47	303	Course " 300A
Theoretical Hydraulics....	Hydraulics 1....	15	3	.....	26	111	Courses " 101-102
Hydraulic Laboratory.....	" 2....	15	.....	3	26	112	Concurrent with course 111
Military Training.....	Military Sci. 3..	15	.....	2	33	502	Courses No. 500-501
Social & Ind. Economics...	Economics 1....	15	2	.....	35	602	Third Year Entrance

Fourth Year. **Second Semester.**

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Alter. Currents & Mach'y.	Elect. Eng. 11	15	3	.....	39	204	Course No. 203
Elect. Railways.....	" " 19	First 8	2	.....	40	211A	Courses No. 201-251
Electrical Transmission....	" " 20	Last 7	2	.....	41	211B	" No. 201-251
Elect. Mach. Design.....	" " 18	15	.....	6	42	213	Course No. 212
Elec. Eng. Laboratory.....	" " 12	15	.....	6	43	253	" No. 252
Hydraulic Engineering....	Hydraulics 3....	15	3	.....	31	153	Courses No. 111-112
Elect. Power Plant Eng...	Elect. Eng. 15...	15	3	.....	40	209	" No. 202-251
Mach. Design Theory.....	Mech. Eng. 16..	15	3	.....	51	330B	Course No. 329B
Engineering Law.....	Contracts.....	15	1	.....	35	601	Third Year Entrance
Military Training.....	Mil. Sci. 4.....	15	.....	2	33	503	Courses No. 500-502
Social & Ind. Economics...	Economics 2....	15	2	.....	35	603	Third Year Entrance

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Electric Eng. Practice	Elect. Eng. 23	15	2		39	216	Third Year Entrance
Electrical Lab	Elec. Eng. 25	15		3	43	254	Concurrent with course 216
Thermo. & Steam Eng	Mech. Eng. 30	15	3		46	300B	Third Year Entrance
Mech. Eng. Lab	Mech. Eng. 3	15	1	3	48	350	Third Year Entrance
Mechanics of Eng. I	Mechanics I	15	5		24	101	Third Year Entrance
Mach. Design Theory	Mech. Eng. 1	15	3		49	329	Third Year Entrance
Mach. Design Drawing	Mech. Eng. 2	15		6	50	331	Concurrent with 329
Machine Shop Practice	Mech. Eng. 20	15		4	48	340	Third Year Entrance
Military Training	Military Sci. I	15		2	33	500	Third Year Entrance

Third Year. **Second Semester**

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Elect. Eng. Practice	Elect. Eng. 24	15	2		39	217	Course No. 216
Electrical Lab	Elec. Eng. 26	15		3	43	255	Concurrent with No. 217
Thermo. and Steam Eng	Mech. Eng. 27	15	3		46	301B	Course No. 300B
Mech. Eng. Lab	" " 29	15	1	3	48	351	Course No. 350
Mechanics of Eng: II	Mechanics 2	15	3		24	102	Course No. 101
Materials Testing II	Mechanics 3	15		3	25	103	Concurrent with 102
Structures 1-A	Civil Eng. 24	15	2		25	106	Course No. 101
Machine Design Theory	Mech. Eng. 3	15	2		49	330	Course No. 329
Machine Design Drawing	" " 5	15		6	50	332	Course No. 331
Machine Shop Practice	" " 21	15		4	40	341	Course No. 340
Tech. Writing	English I	15	1		35	600	Third Year Entrance
Military Training	Mil Science 2	15		2	33	501	Course No. 500

Fourth Year — MECHANICAL ENGINEERING. — First Semester

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Mach. Design Theory	Mech. Eng. 7	15	2	.....	51	329B	Courses No. 329–330
Steam Power Plants	" " 8	15	3	.....	47	303	Courses No. 300B–301B
Mech. Eng. Lab	" " 6	15	.....	3	49	352	Course No. 351
Heating & Ventilating	" " 12	15	3	.....	49	322	Courses No. 300–301B
Theoretical Hydraulics	Hydraulics 1	15	3	.....	26	111	Courses No. 101–102
Hydraulic Lab	" 2	15	.....	3	26	112	Concurrent with 111
Machine Shop Practice	Mech. Eng. 22	15	.....	4	40	342	Course 341
Mech. Eng. Abstracts	Mech. Eng. 13	15	1	.....	48	307	Third Year Entrance
Mach. Design	Mech. Eng. 9	15	.....	3	50	333	Course 332
Metallurgy of Iron & Steel	Metallurgy 7	15	2	.....	57	429	Third Year Entrance
Social and Ind. Economics	Economics 1	15	2	.....	35	602	Third Year Entrance
Military Training	Mil. Science 3	15	.....	2	33	502	Courses 500–501

Fourth Year. — Second Semester.

SUBJECTS	Reference Title	Weeks	Hours per week: Lectures or Class Room	Hours per week: Field, Laboratory, or Drafting	For details see: Page	For details see: Course	Pre-Requisites and Remarks
Hydraulic Engineering	Hydraulics 3	15	3	.....	31	153	Courses 111–112
Steam Turbines	Mech. Eng. 10	15	2	.....	47	305	Courses 300B–301B
Gas Engines	" " 11	15	3	.....	48	306	Courses 300B–301B
Mech. Eng. Lab	" " 17	15	.....	3	49	353	Course No. 352
Mach. Design Theory	" " 16	15	3	.....	51	330B	Course No. 329B
Mach. Design	" " 25	15	.....	3	50	334	Courses No. 333
Engineering Law	Contracts	15	1	.....	35	601	Third Year Entrance
Machine Shop Practice	Mech Eng. 23	15	.....	4	40	343	Course No. 342
Steam Engine Design	Mech. Eng. 28	15	.....	3	51	344	Courses 329–330B
Military Training	Mil. Science 4	15	.....	2	33	503	Course 502
Social and Ind. Economics	Economics 2	15	2		35	603	Course 602
Elec. Power Plant Eng.	Elec. Eng. 15	15	3	.....	40	209	Courses No. 202-251

Third Year. **MINING ENGINEERING.** **First Semester.**

Summer Surveying. Three Weeks Field Practice. Course No. 123 Page 28.

SUBJECTS	Reference Title	Weeks	Hours per week		For details see		Pre-Requisites and Remarks
			Lectures or Class Room	Field, Laboratory, or Drafting	Page	Course	
Mech. of Engineering I	Mechanics 1	15	5	.....	24	101	Third Year Entrance
Steam Eng. Practice	Mech. Eng. 26	15	2	.....	46	300A	"
Mech. Engineering Lab.	Mech. Eng. 29	15	1	3	48	350	"
Qualitative Analysis	Chemistry 1	15	1	6	52	403	"
Mineralogy	Geology 1	15	2	4	53	406	"
Principles of Metallurgy	Metallurgy 1	15	2	.....	54	425	"
Mine Sur. & Mapping	Mining 7	15	1	3	59	415	Engineering Camp
Explosives & Comp. Air Mach.	Mining 1	15	2	.....	62	463	Third Year Entrance
Military Training	Military Sci. 1	15		2	33	500	" " "

Third Year. **Second Semester**

SUBJECTS	Reference Title	Weeks	Hours per week		For details see		Pre-Requisites and Remarks
			Lectures or Class Room	Field, Laboratory, or Drafting	Page	Course	
Mech. of Engineering II	Mechanics 2	15	3	.....	24	102	Course No. 101
Materials Testing II	Mechanics 3	15	.....	3	25	103	" " 101
Quantitative Analysis	Chemistry 2	15	1	9	53	404,404A	" " 403
Assaying	" 3	15	1	4	54	420	" " 403
Met. of Iron & Steel	Metallurgy 3	15	2	.....	55	427	Courses No. 403, 425
Electrometallurgy	" 4	15	1	.....	56	428	Course No. 425
Structural Geology	Geology 2	15	2	1	57	405	" " 406
Technical Writing	English 1	15	1	.....	35	600	Third Year Entrance
Boring, Drifting & Shaft Sinking	Mining 2	15	3	.....	62	464	Third Year Entrance
Military Training	Mil. Sci. 2	15		2	33	501	Course No. 500

Fourth Year. **MINING ENGINEERING.** **First Semester.**

SUBJECTS	Reference Title	Weeks	Hours per week		For details see		Pre-Requisites and Remarks
			Lectures or Class Room	Field, Laboratory, or Drafting	Page	Course	
Theoritical Hydraulics	Hydraulics 1	15	3		26	111	Courses No. 101, 102
Hydraulic Laboratory	" 2	15		3	26	112	" " 101, 102
Electrical Eng. Practice	Elec. Eng. 23	15	2		39	216	Third Year Entrance
Elec. Laboratory	" " 25	15		3	43	254	" " "
Non-Ferrous Metallurgy	Metallurgy 2	15	3		60	426	Course No. 425
Ore Dressing	" 5	15	2		58	453	" " 406
Ore Dressing Laboratory	" 6	15		3	58	453	" " 406
Economic Geology	Geology 3	15	2		57	407	Courses No. 405, 406
Mill Construction	Mining 3	15	2		61	460	" " 102, 105
Mine Plant Design	" 4	15		6	61	461	" " 102, 105, 460
Pros. Dev. & Methods of Mining	" 5	15	3		63	465	Third Year Entrance
Social & Ind. Economics	Economics 1	15	2		35	602	Third Year Entrance
Military Training	Mil. Sci. 3	15		2	33	502	Course No. 501

SUBJECTS	Reference Title	Weeks	Hours per week		For details see		Pre-Requisites and Remarks
			Lectures or Class Room	Field, Laboratory, or Drafting	Page	Course	
Electrical Eng. Practice	Elec. Eng. 24	15	3	.....	39	217	Course No. 216
Elec. Laboratory	" " 26	15	.....	3	43	255	" " 254
Mine Drainage, Haulage, Ventilation	Mining 6	15	2	.....	63	466	
Economic Geology	Geology 4	15	2	.....	58	408	Course No. 407
Ore Dressing	Metallurgy 5	15	2	.....	59	455	" " 453
Ore Dressing Laboratory	" 6	15	.....	6	59	455	" " 453
Metallurgical Laboratory	" 4	15	.....	3	55	410	Courses No. 425, 427
Mine Plant Design	Mining 4	15	.....	8	61	462	Course No. 461
Valuation & Accounting	" 8	15	1	.....	65	467	
Engineering Law	Contracts	15	1	.....	35	601	Third Year Entrance.
Social & Ind. Economics	Economics 2	15	2	.....	35	603	Course No. 602
Military Training	Mil. Sci. 4	....	.....	2	33	503	" " 502

GRADUATES OF THE NOVA SCOTIA TECHNICAL COLLEGE.

	Name	Home Address	Degree
1910	F. R. Archibald	Halifax, N. S.	Civil Engineering
	F. M. Dawson	Truro, N. S.	Civil Engineering
	C. L. Dimock	Upper Newport, N. S.	Civil Engineering
	T. W. Hardy, Jr	Halifax, N. S.	Mining Engineering
	E. S. Kent	Truro, N. S.	Civil Engineering
	A. G. McAulay	Glace Bay, N. S.	Civil Engineering
	*N. W. McKay	Balmoral Mills	Mining Engineering
	Walter Putnam	Maitland, N. S.	Civil Engineering
	E. L. Thorne, Jr	Dartmouth, N. S.	Civil Engineering

*Not granted full diploma.

1911	H. F. Bober	Windsor, N. S.	Electrical Engineering
	J. L. Cavanagh	New Glasgow, N. S.	Mining Engineering
	K. G. Chisholm	Halifax, N. S.	Civil Engineering
	D. M. Collingwood	Upper Parkstone, Eng.	Mining Engineering
	T. M. DeBlois	Halifax, N. S.	Electrical Engineering
	C. K. Hood	Yarmouth, N. S.	Electrical Engineering
	J. F. Lumsden	Gabarus, C. B.	Electrical Engineering
	R. W. McColough	Waverly, N. S.	Civil Engineering
	*C. H. MacDonald	Sydney, C. B.	Civil Engineering
	J. A. MacKay	Balmoral Mills, N. S.	Civil Engineering
	L. A. Myiius	Halifax, N. S.	Mining Engineering
	Gordon S. Stairs	Halifax, N. S.	Civil Engineering

*Deceased

1912	*G. V. Boone	St. Johns' Nfld	Electrical Engineering
	D. R. McKean	West LaHave, N. S.	Civil Engineering
	C. E. McKenzie	Springhill, N. S.	Mining Engineering
	Ranald McKinnon	New Aberdeen, N. S.	Civil Engineering
	J. W. Morrison	Oldham, N. S.	Mining Engineering
	C. B. North	Hantsport, N. S.	Mining Engineering
	G. F. Simpson	Halifax, N. S.	Electrical Engineering

*Deceased

GRADUATES OF THE NOVA SCOTIA TECHNICAL COLLEGE.

	Name	Home Address	Degree
1913	R. B. Carson	Dartmouth, N. S.	Electrical Engineering
	O. S. Cox	UpperStewiacke, N. S.	Civil Engineering
	C. S. Creighton	Dartmouth, N. S.	Civil Engineering
	H. W. L. Doane	Halifax, N. S.	Civil Engineering
	J. D. Irving	New Glasgow, N. S.	Mech. Engineering
	L. B. McCurdy	Truro, N. S.	Civil Engineering
	H. S. McKean	North Sydney, N. S	Electrical Engineering
	I. P. Macnab	Upper Malagash, N. S.	Mech. Engineering.
	W. H. Noonan	Pictou, N. S	Civil Engineering
	J. P. Norrie	Truro, N. S.	Mining Engineering
	M. H. O'Brien	Springhill, N. S.	Mining Engineering
	F. H. Palmer	Halifax, N. S.	Civil Engineering
1914	E W. G. Chapman	Halifax, N. S.	Civil Engineering
	R. P. Donkin	Halifax, N. S.	Mech. Engineering
	C. A. DeWitt Fowler	Halifax, N. S.	Civil Engineering
	S. W. Gray	Westville, N. S.	Civil Engineering
	H. W. Mahon	Great Village, N. S.	Civil Engineering
	J. P. Messervey	Halifax, N. S.	Mining Engineering
	*D. R. Munro	Amherst, N. S.	Electrical Engineering
	R. Murray	Springhill, N. S.	Electrical Engineering
	T. J. MacKavanagh	Shawinigan Falls, P. Q	Electrical Engineering
	R. B. Roach	Windsor, N. S.	Electrical Engineering
	K. E. Whitman	Petite Riviere, N. S.	Civil Engineering
1915	Robt. Porter Freeman	Halifax, N. S.	Civil Engineering
	Rupert Melvin Kinnie	Berwick, N. S.	Civil Engineering
	Angus Ernest McPhie	West Bay. C. B.	Civil Engineering
	James Welton Spence	St. Croix, N. S.	Civil Engineering
	C. H. P. Williston	Halifax, N. S.	Civil Engineering
	William E. Jefferson	Lawrencetown, N. S.	Electrical Engineering
	Olin Edman Prestwood	Sydney Mines, N. S.	Electrical Engineering & Mech. Engineering
	*Donald Rice Munro	Amherst, N. S.	Mech. Engineering
	Waldo Perley Crowe	Wolfville, N. S.	Mining Engineering

*Deceased

*Deceased.

GRADUATES OF THE NOVA SCOTIA TECHNICAL COLLEGE.

	Name	Home Address	Degree
1916	J. R. Chipman	Kentville, N. S.	Civil Engineering
	James B. Hayes	Halifax, N. S.	Civil Engineering
	Rowland C. Moore	Halifax, N. S.	Civil Engineering
	Richard L. Nixon	Kentville, N. S.	Civil Engineering
	John J. Sears	Antigonish, N. S.	Civil Engineering
	Leslie C. Strickland	Trenton, N. S.	Civil Engineering
	William H. Chisholm	Halifax, N. S.	Mech. Engineering
	Clarke O. Noble	New York, U. S. A.	Mining Engineering
1917	Kenneth L. Dawson	York, P. E. I.	Civil Engineering
	Samuel K. Payzant	Falmouth, N. S.	Civil Engineering
1918	Joseph Henry Ryan	Halifax, N. S.	Civil Engineering
	Joseph C. Ells	Selma, Hants Co. N. S.	Civil Engineering
	Wallace Wyniard Smith	Lunenburg, N. S.	Civil Engineering
	John H. T. Morrison	Woodstock, N. B.	Civil Engineering
	Robert John Cragg	Halifax, N. S.	Mech. Engineering
1920	Dale Milner Farnham	Bridgewater, N. S.	Civil Engineering
	Stephen Lloyd Fultz	Halifax, N. S.	Civil Engineering
	William Gathorne Hardy	Montreal, P. Q.	Civil Engineering
	John Howard Hickey	Halifax, N. S.	Civil Engineering
	Albert E. Macdonald	Halifax, N. S.	Civil Engineering
	John Angus Macdonald	Sherbrooke, N. S.	Civil Engineering
	Gerald Alexander Boate	Maitland, Hts. Co. N. S.	Mech. Engineering
	Carleton A. Canavan	Windsor, N. S.	Mech. "
	John H. Macdonald	Sydney Mines, N. S.	Mech. "
	Walter Ross Clarke	Joggins, N. S.	Mech. "
	Gerald Louis Jones	Port Greville, N. S.	Electrical "
	David A. Y. Colquhoun	Halifax, N. S.	Mining "

GRADUATES OF THE NOVA SCOTIA TECHNICAL COLLEGE.

	Name	Home Address	Degree
1921	Kenneth N. Buchanan	Jersey Cove, N. S.	Civil Engineering
	Andrew L. Doucette	Yarmouth, N. S.	Civil Engineering
	Luke B. Feetham	Halifax, N. S.	Civil Engineering
	Monson F. Goudge	Windsor, N. S.	Mining Engineering
	George R. Holmes	Hamilton, Bermuda	Mech. Engineering
	Thomas B. Kerr	Halifax, N. S.	Elec. Engineerng
	Kenneth MacKenzie	Malagash, N. S.	Civil Engineering
	Malcolm J. MacMillan	Marion Bridge, N. S.	Civil Engineering
	Raymond D. Stiles	Pictou, N. S.	Mech. Engineering
	Harold R. Theakston	Sydney, N. S.	Mining Engineering
	Clyde O. Whitman	New Albany, N. S.	Civil Engineering

SHORT COURSES.

RECIPIENTS OF DIPLOMAS.

Name	Home Address	Course	Year
W. H. Hooke	Halifax, N. S.	Land Surveying	1911
R. A. Logan	M. Musquodoboit, N.S	Land Surveying	1911
R. J. Macdonald	Halifax, N. S.	Land Surveying	1911
R. J. Milgate	Middleton, N. S.	Land Surveying	1911
P. G. Morrow	Halifax, N. S.	Land Surveying	1911
Lindsay K. Patterson	Aylesford N. S.	Land Surveying	1912
Chas. F. Whitman	Halifax, N. S.	Land Surveying	1912
A. M. Foster	Bridgetown, N. S.	Land Surveying	1912
Raymond Chisholm	Harbor Bouche, N. S.	Land Surveying	1912
Daniel A. Gasper	Truro, N. S.	Land Surveying	1912
J. O. Hunton	Sackville, N. B.	Land Surveying	1912
*William L. Brine	French Village, N. S.	Land Surveying	1913
Vincent, R. E. Harrison	Southampton, N. S.	Land Surveying	1913
Freeman Tupper	Milton, N. S.	Land Surveying	1913
Harry E. McDonald	D'Escouse, C. B.	Land Surveying	1913
G. W. G. Allen	Halifax, N. S.	Land Surveying	1914
Peter Baxendale	Sydney Mines, N. S.	Land Surveying	1914
Thomas H. Benthan	Sydney Mines, N. S.	Land Surveying	1914
Frank P. Brennan	Halifax, N. S.	Land Surveying	1914
James A. Donovan	Halifax, N. S.	Land Surveying	1914

SHORT COURSES.

RECEIPTENTS OF DIPLOMAS.

Name	Home Address	Course	Year
Reginald Dickie	Brookfield, N. S.	Land Surveying	1914
Edwin Dorey	Dartmouth, N. S.	Land Surveying	1914
Bertram Padmore	England	Land Surveying	1914
G. A. Robertson	Barrington Passage	Land Surveying	1914
F. H. Zwicker	Lunenburg, N. S.	Land Surveying	1914
Arnold R. Millburn	Sydney Mines, N. S.	Metallurgy of Steel	1914
Enna E. Dauphinee	Hubbards	Land Surveying	1915
Robert K. DeLong	Shannon, N. B.	Land Surveying	1915
Frank A. Grant	Halifax	Land Surveying	1915
Bert Grantmeyer	Sydney	Land Surveying	1915
James F. Kelly	Stellarton	Land Surveying	1915
Henry H. Miller	Halifax	Land Surveying	1915
Donald McAskill	Stellarton	Land Surveying	1915
John A. McLellan	Bellecote, C. B.	Land Surveying	1915
Stanley R. Prest	Bedford	Land Surveying	1915
Arthur H. Thompson	Halifax	Land Surveying	1915
Robert S. Wintoa	Stellarton	Land Surveying	1915
Edward G. Maxwell	Halifax	Electrical Machinery	1915
Clarence M. McKay	New Glasgow	Struc. Steel Drafting	1915
Frederick J. Cumming	Halifax	Steam Engineering	1915
William R. Dand	New Glasgow	Steam Engineering	1915
Thomas D. Martin	Halifax	Steam Engineering	1915
Charles C. Brynes	Baddeck	Architectural Drafting	1915
Robert Morton, Jr	Halifax	Architectural Drafting	1915
Peter G. Boutilier	French Village	Land Surveying	1916
Stephen M. Fulton	Sydney	Land Surveying	1916
John C. Walker	Halifax	Land Surveying	1916
Harold Short	Halifax	Electrical Machinery	1916
Ed. T. MacA. Morgan	Smith's Cove	Electrical Machinery	1916
Gordon M. Totten	Sydney	Electrical Machinery	1916
James W. Douglas	Glengarry	Architectural Drawing	1916
William H. Gunn	East River, St. Mary's	Architectural Drawing	1916
Charles C. Brynes	Baddeck	Architectural Drawing 2nd year	1916
Thomas H. Hay	Glace Bay, N. S.	Architectural Drawing	1917
John Birmingham	Sydney Mines, N. S.	Est. & Building Con.	1917
James W. Douglas	New Glasgow, N. S.	Est. & Building Con.	1917
Joseph D. MacDonald	Halifax, N. S.	Land Surveying	1917
Warren S. Grant	Shubenacadie, N. S.	Land Surveying	1917
Howard A. Roberts	Moncton, N. B.	Structural Drafting	1917

*Deceased.

REGULAR STUDENTS REGISTERED 1920-1921.

Name	Home Address	University Previously Attended
Arthur, Harold Francklyn	Halifax, N. S.	Dalhousie
Bayne, Blair E.	Moncton, N. B.	Dalhousie
Beattie, Aubrey Evelyn	Amherst, N. S.	Mount Allison
Buchanan, Kenneth Norman.	Jersey Cove, N. S.	Dalhousie
Cook, Laurie Abram	Lunenburg, N. S.	Mount Allison
Dickson, Thomas Havelock	Pictou, N. S.	Dalhousie
Dobson, Arthur Lea	New Glasgow, N. S.	Dalhousie
Doucette, Andrew Leo	Yarmouth N. S.	Dalhousie
Farnham, Murray Baxter	Bridgewater, N. S.	Mt. Allison
Feetham, Luke B.	Halifax, N. S.	St. Mary's
Gauvin, Leon Gough	Halifax N. S.	Dalhousie
Goudge, Monson Fraser	Windsor, N. S.	Kings
Hayes, St. Claire	Halifax, N. S.	St. Mary's
Holmes, George Raymond	Hamilton, Bermuda	Dalhousie
Kerr, Thos. Bishop	Halifax, N. S.	St. Mary's
Lewis, Chas. Walter Hagar	Yarmouth, N. S.	Mt. Allison
Marshall, Geoffrey James	Halifax, N. S.	Dalhousie
Millett, Ralph Strathie	Windsor, N. S.	Kings
MacKenzie, Kenneth	Malagash, N. S.	Mt. Allison
MacLean, Harold Seymour	Trenton, N. S.	Dalhousie
MacMillan, Malcolm James.	Marion Bridge, C. B.	Dalhousie
North, Victor Ells	Canning, N. S.	Mt. Allison
O'Brien, Frederick Gordon	Windsor, N. S.	Kings
Robertson, Chas. Forman	North Sydney, N. S.	Mt. Allison
Shupe, James Franklin	Halifax, N. S.	Kings
Spence, Howard Nathaniel	St. Croix, N. S.	Kings
Stiles, Raymond Donald	Pictou, N. S.	Mt. Allison
Stokes, Thomas	Halifax, N. S.	St. Mary's
Theakston, Harold Raymond	Sydney, N. S.	Dalhousie
Turnbull, Aubrey Arnold	Digby, N. S.	Dalhousie
Welton, Carl Reginald	Tremont, N. S.	Acadia
Whitman, Clyde Oliver	New Albany, N. S.	Acadia
Winter, Thos. Hinson	St. John's Nfld.	Kings